ECE 592-083: Innovation and the IoT Marketplace
(Paired with: MBA 590)
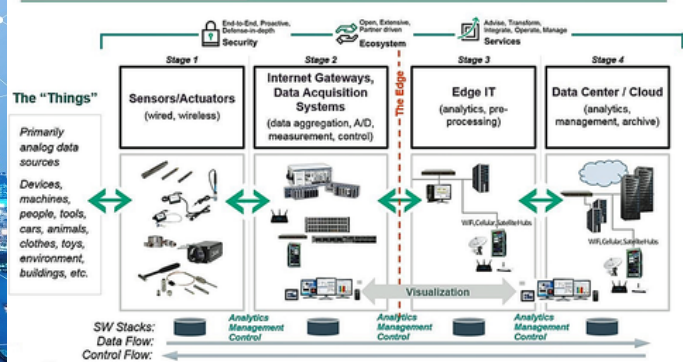
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Limited enrollment: 10 seats
Recommend discussing with instructor before enrolling.

The Internet of Things (IoT) is growing rapidly across many industries, becoming a highly important economic engine and source of innovation. Whether smart cities, smart homes, smart machinery, wearable technologies, or analytics, IoT has become both a major challenge and opportunity for many companies.

This ECE 591 course is paired with MBA 590 on-line course that is a practicum for MBA students. It is a project-oriented course with a focus on design thinking and innovation. Approximately 5 real world projects connected to IoT will be developed with input from companies that have an IoT focus, and input from the non-profit NC RIoT, which represents a network of companies operating in the IoT technology and market space. The projects will perform market analysis of emerging IoT technologies, customer analysis and launch strategies for IoT projects and services building the technical and business case.

The role of the engineers in this course is to provide a technical perspective and provide a technical underpinning to the project and depending on the project can build prototypes to enhance the project and the business case. The technical perspective we are looking for from the engineering components of the team includes developing an understanding the performance and specifications of the sensors, making appropriate engineering decisions about sensors, understanding bandwidth and data, and data analytics requirements, and networking and system architecture issues. However, we do not expect any single engineer to know or be an expert in all of these areas and will take the engineering student's skill set into account when developing projects.

The course objectives are to provide each ECE student with:
- A technical understanding of essential IoT building blocks
- Hands-on project experience in analyzing an IoT business opportunity and recommending an innovation strategy that includes a technical specifications.
- The managerial mindset to realize business value in the IoT marketplace, with enough technical realism to provide a technical approach to building the innovation.

Contacting the Instructor

Contact information for the instructor is at the top of this syllabus. Office hours will generally be conducted via "Collaborate" session by request. Email is usually a quick and effective way to reach the instructor, who will strive to reply within 24 hours if able to do so. Appointments for a phone or Skype/Hangout conversation can easily be arranged.
For Tech Support: Contact the NCSU Help Desk at: 919-515-HELP or help@ncsu.edu.

Expectations

It is critical to participate in class, keep up with course readings and materials, and be engaged in your project. The instructor is more than happy to interact with individual students or teams anytime/anywhere (within reason) to help in your studies. Learn. Have fun. Do good work!

Course Delivery and Structure

Students participate in three main activities to meet the course objectives:

1) Your active participation in the class is vital! Assigned readings, materials, and class activities help students study the many facets of IoT and how it is impacting innovation in industries and markets. Interactions with guest experts may be scheduled in a convenient format.

2) Occasional exercises give students more experience with specific aspects of IoT. This will primarily occur through a "Short Take" each student will prepare. A Short Take is like a primer, conveying essential detail about a specific IoT topic of interest, relevant to managers, that goes beyond what is covered in other course materials. Another exercise will cover key readings.

3) It's the PROJECT! As a practicum course, your team project is the primary activity. You will learn by doing, and share that learning with fellow classmates and outside experts in the IoT community. Project teams will be formed early.

The course will be somewhat fluid. This partially reflects a desire for flexibility, incorporating new material and student ideas/input as they arise. As a new course on a broad topic, it seems natural to give ourselves room to be creative and make the most out of each project. Also, guest speakers or other interactions with the robust IoT community may be added as the opportunity arises, so it is impossible to rigidly plan the entire semester.

The course will be taught online, mostly in an asynchronous environment. However, you should expect weekly (or nearly so) live interactions during the semester for project reviews or other course activities. The course's Moodle page contains files and links for course materials.

The course schedule is organized by weeks, starting on a Monday. A different course topic will usually cover a two-week period. Course Content is posted on Moodle.

Course Materials

Course readings, class notes, and other materials will also be posted online. The course website will be updated frequently, so you should check often for new materials.

Course Requirements and Grading

Assignments during the semester include required readings, exercises, and reports. It is important to maintain progress in the class and stay on schedule.

The grade is determined as follows:

Class Participation:	**10%**	
Class Exercise, "Short Take":	**15%**	
Team Project Deliverables:	**75%**	10% Project Brief
		15% Interim Review
		15% Final Presentation
		25% Final Report
		10% Executive Summary

The default grading scale is: $93 \leq A \leq 100$; $90 \leq A- < 93$; $87 \leq B+ < 90$; $83 \leq B < 87$; $80 \leq B- < 83$; etc. for lower grades. There may be upward adjustments in the final grade based on the performance of the entire class. The expected average performance of graduate students is a B+ grade. Exceptional performance may receive an A/A+ grade, while performance below average may result in a grade of B or lower.

Details about each assignment will be posted and discussed in class. A summary follows:

1) *Class participation (Individual)*

You should strive to engage in thoughtful, timely, and professional participation throughout the semester. Class participation points are gained through several methods:

a) Submit any article, graphic, or video clip from the real world (*Wall Street Journal*, CNBC, a TV ad, photo of a customer problem, etc.) relevant to class topics. This "Real Business Illustration" (RBI) should be accompanied by a brief technical analysis/synopsis (1-2 paragraphs) on how the media illustrates key course concepts or IoT trends.
b) Engage in one or more discussion forums related to a class reading or activity through the course website. Post your insights and engage in a discussion with the instructor and fellow students. You can also comment on RBIs or other student postings.
c) Participate in an IoT activity. During the semester, you can engage in local IoT events or other IoT networking opportunities that may occur. Interactions with the IoT community are a great way to see what's happening in the IoT marketplace. Opportunities will be posted on Moodle. Also check out "RIoT" – www.ncriot.org .

For each episode of class participation (discussion forum, RBI, etc.) each student will be assigned 1 to 5 points based on the **quality** of their discussion or participation in terms of demonstrating thoughtful preparation, analysis, and insights of class topics. At semester's end, all class participation points will be added for each student, and the class participation score will represent the student's relative point ranking in the class.

2) *Class Exercise and "Short Take" (Individual or Group)*

Each student, individually or in pairs, will prepare a primer on one IoT topic of interest that is relevant to the course. This "short take" should reflect a specific issue, and be based on one or more articles (**not** among assigned readings) and/or research compiled from multiple sources. The Short Take should be like a primer or executive summary, conveying essential points about the topic to the class beyond what is covered in course materials. Deliverable is a brief (3-pages of single-spaced text, plus any number of exhibits and additional readings) relevant to managers. A good "short take" will give key insights about a specific topic, with illustrative examples. An additional exercise will allow you to create managerial insights based on several assigned readings. Details to be posted; due dates to be arranged.

3) *Team Project (Group)*

During the semester you will be part of a team project. There are five main project deliverables:

a) Project Brief – as a team, you will write a project brief (like a problem statement and proposal) and provide an outline of your project activities, challenges, and schedule.
b) Interim Review – an interim review will focus on your progress and project findings.
c) Final Presentation – your project outcomes and lessons will be presented to the instructor and a "jury" of outside experts.
d) Final Report – submit a final report of your project accomplishments and recommendations.
e) Executive Summary – prepare a 2-page executive summary of project highlights.

Peer evaluations will be considered in assigning final project grades. Project teams should have an "all hands on deck" attitude to meet project goals and learning outcomes.

Regular team meetings will occur with the instructor. Early in the semester, project teams will work with the instructor to form a schedule of project meetings. Meetings with external project sponsors and experts will also occur. As a team, you should work out the best frequency and mode of meeting (in-person, Google Hang-Out, etc.) that allows you to complete your project work.

Further details will be discussed in class.

Course Schedule (see Moodle for details)

Week	Dates	Topic	Major Project Assignments
1	Jan. 8-15	Course Introduction	Project Team Formation
2-3	Jan. 15-29	IoT Market Opportunities	Project Brief Due by Jan. 29
4-5	Jan. 29 to Feb. 12	Industrial IoT or Industry 4.0	
6-7	Feb. 12-26	IoT Technologies and Systems	
8	Feb. 26 to Mar. 4	Project Reviews	Interim Reviews to be scheduled for this week
	Mar. 4-12	**Spring Break!**	
9-10	Mar. 12-26	User Experience Design and IoT	
11-12	Mar. 26 to Apr. 9	Data	
13-14	Apr. 9-23	IoT Challenges and Future Directions	
15	Apr. 23-27	Project Wrap-Up	Final Project Deliverables Due

This is only an outline of the semester, capturing the general order of topics and project milestones. Details posted on Moodle.

General Policies and Procedures

Late Assignments
All assignments are due at the date/time posted for each assignment. It is expected that all written assignments will be typed and of professional quality. Assignments may be added or changed as the term progresses. **No late assignments will be accepted without prior arrangement.**

Class Participation and Team Policy
Class participation and attendance at all team/class meetings are expected. MBA teams are expected to function cohesively and professionally with each member, and contribute to the project consistent with the student's best efforts. Teams should diligently set project schedules and expectations, and proactively address any concerns or issues of student non-performance (including instructor intervention). The MBA policy on students teams may be found at http://poole.ncsu.edu/mba/current-students/policies-procedures. Dismissal from any project team part-way through the semester will result in the dismissed student receiving a zero score for the project. Peer evaluations of your project team may affect your grade. For complete attendance and excused absence policies, see http://policies.ncsu.edu/regulation/reg-02-20-03.

Academic Integrity and Honesty
Students are expected to understand and follow the policies on academic conduct (http://policies.ncsu.edu/policy/pol-11-35-01). Academic dishonesty will be severely penalized. Submission of any test or assignment indicates your agreement with the statement: "I have neither given nor received unauthorized aid on this test or assignment."

Incomplete Grades
The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at http://policies.ncsu.edu/regulation/reg-02-50-03.   Additional information relative to incomplete grades for graduate students can be found in the Graduate Administrative Handbook Section 3.18.F http://www.fis.ncsu.edu/grad_publicns/handbook/.

Electronically-Hosted Components
Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. The course may also involve sharing of student work with persons not taking or administering the course, such as project sponsors or outside experts. All students are expected to respect the privacy of each other by not sharing or using such information outside the course. See policy details at http://www.ncsu.edu/policies/informationtechnology/pdf/REG08.00.11.doc.

Students with Disabilities
Reasonable accommodations will be made for students with verifiable disabilities who have registered with the Disability Services Office (http://www.ncsu.edu/dso), 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at http://policies.ncsu.edu/regulation/reg-02-20-01.

Non-Discrimination Policy
NC State University provides equality of opportunity in education and employment for all students and employees. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or http://www.ncsu.edu/equal_op/. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.