Course Description:
The goal of this course is to introduce students to the concepts, approaches and implementation issues associated with data acquisition for buildings and building systems. Students are introduced to the types of data that are collected for infrastructure systems, sensing technologies, data acquisition using sensors, processing techniques, and use of sensing in a variety of applications in construction and infrastructure management. Students also gain experience with some of the data acquisition hardware and software. Applications range from environmental monitoring and seismic studies to mobile target tracking.

This is a new and rapidly developing research area with many open problems of cross-disciplinary interest. This course also aims to train students in the craft of academic research. Students will have an opportunity to contribute to this area through the publication of results from the final research project for this class. Substantial emphasis will be placed on reading research papers in a critical and analytical manner. Students will be required to turn in regular written critiques of papers. The final project will be closely monitored through out-of-class meetings and emails, and will span the full research cycle - from problem formulation to obtaining & analyzing results to paper writing.

Prerequisites:
There are no prerequisites for the course. Students are expected to have strong research interests and analytical ability. The course is meant to be for PhD students in CEE as well as MS students with a high level of ability, self-motivation and an interest in research.

Office Hours: Other hours by appointment only. Students are advised to make appointments with the professor ahead of time and be specific with the subject matter to be discussed. Students should also be prepared for their appointment by bringing all applicable materials and information.

Class Communication:
Blackboard will be used for class communication, assignment submissions and reading materials.

Policy about Assignments:
It is crucial that students turn in whatever they have on the due date. NO assignment will be accepted late. An incomplete grade will only be issued when a student is unable to complete the work because of documented illness.

Reading Assignments:
This course aims to train students in the craft of academic research. Substantial emphasis will be placed on reading research papers in a critical and analytical manner. Students will be required to turn in regular written critiques of papers.

Final Research Project:
Besides the weekly lectures, critiques, and discussion, a large component of the course will be the execution and delivery of a research project. Students will prepare a proposal for their research
project that could be designed, implemented and analyzed within a semester. Details on this will be provided during the semester. The projects will be graded on the basis of individual effort, regular progress updates, the mid-term and final project reports, and final project presentations.

**Grading Schema:**
In this advanced PhD-level course, it is expected that all students will be motivated, responsible for their own learning, and participate enthusiastically. Each student must present and participate actively in the discussions each week in class, and complete all assignments in a timely manner. The course grading policy is accordingly as follows:

Each assignment: 5% (Totaling 15%)
Reading assignments and participation to the class discussions: 15%
Research proposal (Assignment #4): 20%
Research project (Final Assignment): 50%

**Required Readings:**
We will read and discuss the most recent papers from the literature. Reading list will be announced and updated during the semester.

The following book is recommended for the research methodologies part of the class.
1. Encyclopedia of research design

**Assignment #1**
**Reviewing Research:**
Go to MIT’s Media Lab website (http://www.media.mit.edu/) and review the research projects and groups (http://www.media.mit.edu/research/groups-projects). The group that shares similar interests with the course topics is the Responsive Environments Group (http://www.media.mit.edu/resenv/projects.html). Choose two of the projects that interest you most and prepare a presentation for the class. Presentations should include the details of the research, such as point of departure, methodology, results, etc. Make sure you review all of the publications about the research (http://www.media.mit.edu/resenv/papers.html). Your presentation should be around 20 minutes, following a 10 minute Q&A. Besides the project details, include comparative studies that have been done around the topic. Some of the project examples of this group are listed below. However, these are examples, a comprehensive list can be found at: http://www.media.mit.edu/resenv/projects.html

Visualization of Sensor Data in Game Engine: http://www.media.mit.edu/resenv/doppellab/
Adaptive Lighting: http://www.media.mit.edu/resenv/lighting/
Personalized Building Control: http://www.media.mit.edu/resenv/personalcomfort/
Mobile Interface to Sensor Networks:
http://www.media.mit.edu/resenv/tricorder/tricorder.htm
Plug: http://www.media.mit.edu/resenv/plug/
Sensing Modeling Capturing Human Behavior (Human Dynamics Lab):
http://reality.media.mit.edu/researchmethods.php

**Assignment #2:**
**Research Ideas:**
Each student will propose a research project that can be executed within a semester and that he or she is interested in exploring. Each student will prepare a formal presentation and we will discuss about the feasibility and novelty of the project during the class.
Assignment #3
Review of Papers:
Each student will be provided a journal paper (that is under review in theory). Students will act as reviewers and provide their scientific reviews in a written form and be prepared to discuss their review with the class. Guidelines for reviewing the paper will be provided. The goal of this exercise is to understand how reviewers/readers think when reading/reviewing your papers.

Assignment #4:
Writing a Research Proposal:
Based on the material provided and the sample proposals you have reviewed; each student will prepare their research proposal that they would like to execute for the remaining part of the semester. A good proposal should include introduction and problem statement, review of related literature, and statement of the hypothesis, methodology, instruments, research design, data collection and analysis methods, and the plan for reporting your findings. The proposal should be around 2-5 pages accompanied with a presentation. Students will present your proposal to the class; be prepared for questions. Students in the class and the instructor will provide feedback.

About project selection: First and foremost, it is important to choose a topic that you can execute in a semester. You need to think about instrumentation, access to instrumentation, cost of instruments, learning curve and lead times, time required for execution of the experiments, time required for analysis of the data and documentation. The project you are going to propose can be related to your ongoing projects or can be a separate endeavor. You can recruit help from colleagues or propose projects that complement each other. Be innovative and make it fun!

Reading Assignments:

Final Assignment: Following the research proposal, each student will execute his or her project. There will be several research meetings throughout the semester. Each student will report his or her research progress to the class. There is no final exam. Instead, students will present their work to the class on the last day of classes. The final report is due the same day of the class during the first week of the exam period. Students can submit their final report in a word document or if they choose, they can submit their final report as a conference submission to one of the conferences listed below (recommended but not required):

1. 19th EG-ICE (European Group of Intelligent Computing in Engineering) International Workshop, Munich, Germany, July 4-6, 2012
3. ASCE Workshop on Computing in Civil Engineering, Clearwater Beach, FL, June 17-20, 2012, Website: TBD
Class Topics:
The following is an outline for the course, describing the topics we will cover through the lectures in this course (subject to change)

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Assignments Due</th>
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| 1    | 08/24  | **INTRODUCTION**  
Instructor, class members and course                                   |                          |
| 2    | 08/31  | **RESEARCH REVIEW**  
STUDENT PRESENTATIONS OF RESEARCH PROJECTS REVIEWED                      | Assign #1                |
| 3    | 09/07  | **CRAFT OF RESEARCH**  
What is research? Why write it up? Connecting with your reader  
From topics to questions to problems to sources  
Making good arguments; claims; reasons and evidence  
Review of literature  
Preparing and drafting  
*How to write a proposal?  
STUDENT PRESENTATIONS OF RESEARCH IDEAS  
| Assign #2                |
| 4    | 09/14  | **HOW TO WRITE A SCIENTIFIC PAPER**  
Preparing title, abstract, introduction, methods, results, discussion, references  
Effective graphs, tables, images  
Manuscript submission, review process, publishing process  
Use and misuse of English  
How to review a paper  
|                          |
| 5    | 09/21  | **Discussion: UPDATE ON RESEARCH PROGRESS: Feasibility; first steps taken?  
Discussion: PAPERS REVIEWED**                                            | Assign #3                |
| 6    | 09/28  | **STUDENT PRESENTATIONS OF PROPOSALS (including comprehensive review of literature)** | Assign #4                |
| 7    | 10/05  | **TECHNOLOGY DEMOSTRATION – TBD**                                      |                          |
| 8    | 10/12  | **DISCUSSION: Reading List 1**                                         | Reading Assignment       |
| 9    | 10/19  | **TECHNOLOGY DEMOSTRATION – TBD**                                       |                          |
| 10   | 10/26  | **MID-TERM PRESENTATIONS: RESEARCH PROGRESS**                          |                          |
| 11   | 11/02  | **TECHNOLOGY DEMOSTRATION – TBD**                                       |                          |
| 12   | 11/09  | **DISCUSSION: Reading List 2**                                         | Reading Assignment       |
| 13   | 11/16  | **DISCUSSION: Reading List 3**                                         | Reading Assignment       |
| 14   | 11/23  | **DISCUSSION: Reading List 4**                                         | Reading Assignment       |
| 15   | 11/30  | **FINAL PRESENTATIONS OF FINDINGS**                                    |                          |
| 12   | 12/07  | **WRITTEN REPORT**                                                     |                          |
Academic Responsibilities:

Students with Disabilities
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. Your letter must be specific as to the nature of any accommodations granted. DSP is located in STU 301 and is open 8:30 am to 5:30 pm, Monday through Friday. The telephone number for DSP is (213) 740-0776.

Academic Integrity
The University, as an instrument of learning, is predicated on the existence of an environment of integrity. As members of the academic community, faculty, students, and administrative officials share the responsibility for maintaining this environment. Faculties have the primary responsibility for establishing and maintaining an atmosphere and attitude of academic integrity such that the enterprise may flourish in an open and honest way. Students share this responsibility for maintaining standards of academic performance and classroom behavior conducive to the learning process. Administrative officials are responsible for the establishment and maintenance of procedures to support and enforce those academic standards. Thus, the entire University community bears the responsibility for maintaining an environment of integrity and for taking appropriate action to sanction individuals involved in any violation. When there is a clear indication that such individuals are unwilling or unable to support these standards, they should not be allowed to remain in the University.” (Faculty Handbook, 1994:20)

Academic dishonesty includes: (Faculty Handbook, 1994: 21-22)
Examination behavior – any use of external assistance during an examination shall be considered academically dishonest unless expressly permitted by the teacher.
Fabrication – any intentional falsification or invention of data or citation in an academic exercise will be considered a violation of academic integrity.
Plagiarism – the appropriation and subsequent passing off of another’s ideas or words as one’s own. If the words or ideas of another are used, acknowledgment of the original source must be made through recognized referencing practices.
Other Types of Academic Dishonesty – submitting a paper written by or obtained from another, using a paper or essay in more than one class without the teacher’s express permission, obtaining a copy of an examination in advance without the knowledge and consent of the teacher, changing academic records outside of normal procedures and/or petitions, using another person to complete homework assignments or take-home exams without the knowledge or consent of the teacher.

The use of unauthorized material, communication with fellow students for course assignments, or during a mid-term examination, attempting to benefit from work of another student, past or present and similar behavior that defeats the intent of an assignment or mid-term examination, is unacceptable to the University. It is often difficult to distinguish between a culpable act and inadvertent behavior resulting from the nervous tensions accompanying examinations. Where a clear violation has occurred, however, the instructor may disqualify the student’s work as unacceptable and assign a failing mark on the paper.

Return of Course Assignments
Returned paperwork, unclaimed by a student, will be discarded after a year and hence, will not be available should a grade appeal be pursued following receipt of his/her grade.