# Advanced Construction Information Technologies

CGN 6905 Section 23842
***Class Periods:*** Wednesday Period 9-11 (4:05PM-7:05PM)
***Location:*** MAEB 229
***Academic Term:*** Fall 2019

***Instructor:***
Eric Jing Du
eric.du@essie.ufl.edu
(352) 294-6619
Office Hours: T,R: 4:00PM-5:30PM, 460F Weil Hall

***Course Description***
3 credit hours

***Course Pre-Requisites / Co-Requisites***
Instructor permission

***Course Objectives***
Exploration of emerging technologies for the construction industry including hardware and software systems such as BIM, RFID, sensors, information systems, cloud computing, machine learning, and information strategy planning; using information strategy planning by owners and contractors to effectively enhance the management of business entities and projects in construction. Students will:

1. Understand principals of modern information systems such as Cyber-Physical Systems;
2. Understand the main phases of information processing – sensing, analysis, decision-making, and visualization;
3. Design an information strategy planning for a general contractor, including: i) Identify criteria for the selection of information technologies and design their configuration; ii) the development of an IT implementation plan; iii) Examine state of the art information management methods and tools for system integration; iv) Propose information strategy plans at corporate and/or project level;

***Materials and Supply Fees***
No materials and supply fees.

***Required Textbooks and Software***
No required textbooks.

***Course Schedule*** *(team project demo/presentations/exams highlighted in red)*

| Dates | | Topics | Homework Due | Paper reading |
|---|---|---|---|---|
| 1 | 8/21 | Course Overview; Introduction to: 1) information science; 2) information systems; 3) Cyber-Physical Systems; 4) Human-in-the-loop | -- | -- |
| 2 | 8/28 | Introduction to Big Data | -- | Paper #1: CPS |
| 3 | 9/4 | History of Construction IT: Review and Discussion | HW#1: Facebook | Paper #2: Big Data I |
| 4 | 9/11 | Data Collection - Sensing: Humans and objects; Barcodes; RFID; indoor localization; App development | -- | Paper #3: Big Data II |
| 5 | 9/18 | Data Collection - Sensing cont'd: Structure; scanning (photogrammetry/LiDAR) | -- | Paper #4: Sensing I |
| 6 | 9/25 | Data Collection - Imagery; App Demo | HW#2: App demos | Paper #5: Sensing II |
| 7 | 10/2 | Data Analysis - Statistical modeling | -- | Paper #6: Sensing III |

| | | | | |
|---|---|---|---|---|
| 8 | 10/9 | Data Analysis - Other methods (KMS; BIM)/ Smart design demos | HW#3: Smart building design | Paper #7: BIM I |
| 9 | 10/16 | Data Analysis - Machine Learning/Artificial Intelligence/Deep Learning | -- | Paper #8: BIM II |
| 10 | 10/23 | Data Visualization - Virtual Reality and Augmented Reality | -- | Paper #9: Machine Learning |
| 11 | 10/30 | Life cycle tech solutions for AEC industry | HW#4: Data Analytics in Civil Engineering (Individual) | Paper #10: VR/AR/MR |
| 12 | 11/6 | The Future of Construction Tech: Human-Robot Collaboration; Intelligent Cognitive Assistance; Automation; Additive Manufacturing. | -- | -- |
| 13 | 11/13 | Lab visit | HW#5: Visualization in Civil Engineering (Individual) | |
| 14 | 11/20 | Final Exam: questions and data analysis challenges | -- | -- |
| 15 | 11/27 | HOLIDAY | -- | -- |
| 16 | 12/4 | TERM PROJECT PRESENTATIONS/DEMO | Final Reports Due | |

***Attendance Policy, Class Expectations, and Make-Up Policy***

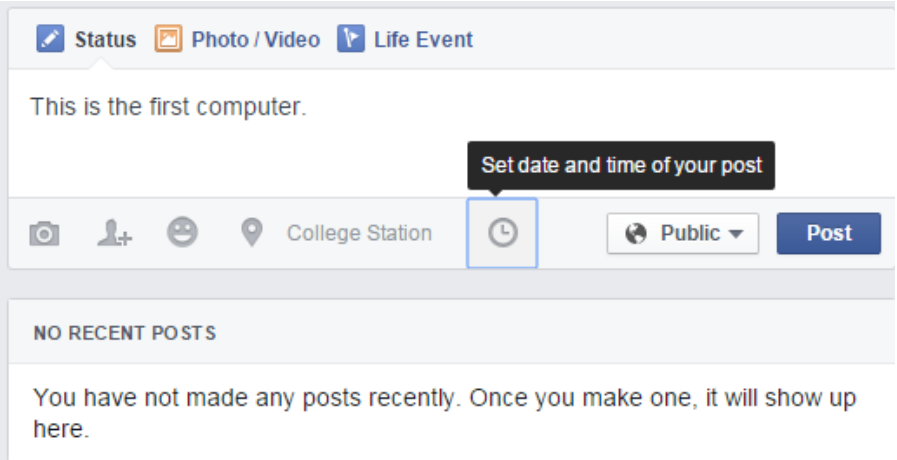
Class attendance is expected. Students are responsible for any information communicated during class. Project presentation attendance is mandatory. Missed presentations can only be made up when it is an excused absence. Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation. Student must contact the instructor as soon as the student knows that he/she will have an excused absence to arrange for makeup.

***Evaluation of Grades***

| ID | Assignment | Total Points | Percentage of Final Grade |
|---|---|---|---|
| | **Individual project** | | |
| A | HW#4: Data Analytics essay | 100 | 10% |
| B | HW#5: Visualization essay | 100 | 10% |
| C | Final Exam | 100 | 30% |
| D | Weekly paper review | 100 | 5% |
| | **Team projects** | | |
| E | HW#1: Facebook timeline | 100 | 5% |
| F | HW#2: Smart app demo | 100 | 5% |
| G | HW#3: Smart building design | 100 | 5% |
| H | Term project | 100 | 30% |
| I | Peer Evaluation (team members) | 1.0 | Multiplier |
| **Final Grade=**(A+B)*10%+ C*30%+D*5%+I*( E+F+G)*5%+I*H*30% | | | |

**HW#1: Facebook Timeline – History of Construction Technologies**

1. Form a team of 2 or 3 (depending on the final headcount).
2. Pick a technology focus area, such as BIM, AI, Robotics etc.
3. Add "ITee" as your friend on Facebook.
4. Log into "ITee" and add new statuses on your selected tech. Please research the HISTORICAL milestones of the selected tech, and add articles, pictures, and/or videos about it. Please note, you also need to set time and date of your posts to when it actually happened. For example, if you added an article about the first computer, you should date your post "February 14, 1946", when the first computer was announced, even though you added the article on September 4, 2019.




**Facebook "ITee" account info**
Xxx
xxx

5. **<u>Present your findings and initiate discussions (30 minutes) in the class on September 4.</u>**
6. It will be peer evaluated based on: (1) Contents (full length articles; videos, images) – 30%; (2) Relevance and Connection to the trend of the selected technology – 20%; (3) Ability to engage class in discussion – 20%.

**HW#2: Smart app development and demo**

1. Form a team of 2 or 3 (depending on the final headcount).
2. Design a smart phone app using idiot-proof development platform, such as AppSheet: https://www.appsheet.com.
3. Consider including the following functions:
    a. GPS tracking
    b. Camera
    c. Barcode scanner
    d. Map
    e. Interactive charts
4. Write a user's manual.
5. **<u>Demonstrate the app (15 minutes) to the class on September 25.</u>**
6. It will be peer evaluated based on: (1) Purpose (how relevant is it to a realistic construction management problem?) – 25%; (2) Development (Did the development follow software development process? (identify needs → User requirement → Architecture → Development → Testing) -25%; (3) Functionality (how effectively and efficiently the app can solve the identified problem? How well does the app meet user needs?) – 25%; (4) Usability (how easy it is to use the app?) – 25%.

**HW#3: Smart building design proposal**

1. Form a team of 2 or 3 (depending on the final headcount).
2. Propose a cost-effective renovation plan for Weil Hall to make it smarter.
3. Consider including the following functions:
    a. Indoor air quality monitoring
    b. Indoor localization
    c. Occupancy status
    d. Energy monitoring and optimization
    e. Emergency system
4. Prepare a presentation file.
5. **<u>Demonstrate the proposal (15 minutes) to the class on October 9.</u>**

6. It will be peer evaluated based on: (1) Purpose (how relevant is it to the needs?) – 30%; (2) Functionality (how effectively and efficiently the proposal can solve the identified problem?) – 30%; (3) Economy (how cost effective is the proposed solution? Please include an estimate of cost) – 40%.

**HW#4: Essay – Data Analytics in Civil Engineering and Construction**

1. Write an essay about the data analytics methods in civil engineering and construction.
2. Based on the current literature and your proposed methods
3. Examples include but not limited to:
    a. Structure monitoring and inspection
    b. Construction productivity
    c. Construction safety
    d. Supply chain
    e. Human factor
    f. Smart buildings
    g. Urban informatics and smarty cities
4. **2,000 – 3,000 words.**
5. It will be evaluated based on: (1) Relevancy (how relevant is it to the domain?) – 30%; (2) Technical writing (how well does the writing follow technical writing standards?) – 30%; (3) Creativity (By the end, did the author present a reasonable proposal to the research area?) – 40%.

**HW#5: Essay – Visualization in Civil Engineering and Construction**

1. Write an essay about the visualization methods (e.g., VR and AR) in civil engineering and construction.
2. Based on the current literature and your proposed methods
3. **2,000 – 3,000 words.**
4. It will be evaluated based on: (1) Relevancy (how relevant is it to the domain?) – 30%; (2) Technical writing (how well does the writing follow technical writing standards?) – 30%; (3) Creativity (By the end, did the author present a reasonable proposal to the research area?) – 40%.

**Term Project (team project)**

1. Form a team of 2 or 3 (depending on the final headcount).
2. Pick a technology focus area from the followings:
    a. Scanning (LiDAR or Photogrammetry)
    b. Sensing
    c. Indoor localization
    d. VR/AR
    e. Machine learning
    f. Human-Robot Collaboration
    g. Human factors in construction projects
3. Design a research project in the selected technology focus area, including: (1) A technical report (~3,000 words) to describe the background, the problem, the objectives, the design of the study or experiment, the results, the findings and conclusions; (2) A demonstration of the technology; (3) A final presentation to the class.
4. **Final demo and presentation (40 minutes) to the class on December 4.**
5. Equipment and devices will be loaned by the instructor if available. STUDENTS MUST MAKE SURE ALL LOAN EQUIPMENT AND DEVICES ARE RETURNED TO THE INSTRUCTOR IN ORIGINAL CONDITIONS.
6. The term project will be evaluated based on: (1) Relevancy (how relevant is it to the domain?) – 20%; (2) Technical development (how well the project was developed to meet the research needs?) – 20%; (3) Technology demonstration (how well did the team demonstrate the developed technology) – 20%; (4) Final report – 40%.

***Grading Policy***

| Percent | Grade | Grade Points |
|---|---|---|
| 90.0 - 100.0 | A | 4.00 |

| | | |
|---|---|---|
| 87.0 - 89.9 | A- | 3.67 |
| 84.0 - 86.9 | B+ | 3.33 |
| 81.0 – 83.9 | B | 3.00 |
| 78.0 - 80.9 | B- | 2.67 |
| 75.0 - 79.9 | C+ | 2.33 |
| 72.0 – 74.9 | C | 2.00 |
| 69.0 - 71.9 | C- | 1.67 |
| 66.0 - 68.9 | D+ | 1.33 |
| 63.0 - 65.9 | D | 1.00 |
| 60.0 - 62.9 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

***Students Requiring Accommodations***

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

***University Honesty Policy***

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

***Campus Resources:***

*Health and Wellness*

**U Matter, We Care:**
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

**Sexual Discrimination, Harassment, Assault, or Violence**
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

**Sexual Assault Recovery Services (SARS)**
Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

*Academic Resources*

**E-learning technical suppor***t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

**Library Support**, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

**Student Complaints Campus***:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

**On-Line Students Complaints***:* http://www.distance.ufl.edu/student-complaint-process.