Advanced Construction Information Technologies

CGN 6905 Section 22715
Class Periods: Wednesday Period 9-11 (4:05PM – 7:05PM EST)
Location: MAEB0234
Zoom (when needed – instructor permission): https://ufl.zoom.us/j/4369404526
Academic Term: Fall 2022

Instructor:
Eric Jing Du
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(352) 294-6619
Office Hours: W: 2:00PM-3:30PM, Zoom: https://ufl.zoom.us/j/4369404526

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	8/24	Course Overview; Introduction to: 1) information science; 2) information systems; 3) Cyber-Physical Systems; 4) Human-in-the-loop	--	--
2	8/31	Introduction to Big Data	--	Paper #1: CPS
3	9/7	History of Construction IT: Review and Discussion	HW#1: Facebook	Paper #2: Big Data I
4	9/14	Data Collection - Sensing: Humans and objects; Barcodes; RFID; indoor localization; App development	--	Paper #3: Big Data II
5	9/21	Class project: Arduino sensor development (materials will be provided by instructor)	--	Paper #4: Sensing I
6	9/28	Data Collection - Sensing cont'd: Structure; scanning (photogrammetry/LiDAR); Smart Phone App Demo	HW#2: App demos	Paper #5: Sensing II
7	10/5	Data Collection - Imagery	--	Paper #6: Sensing III
8	10/12	Data Analysis - Statistical modeling; Smart building design proposal presentation	HW#3: Smart building design	Paper #7: BIM I
9	10/19	Data Analysis - Other methods (KMS; BIM)	--	Paper #8: BIM II
10	10/26	Data Analysis - Machine Learning/Artificial Intelligence/Deep Learning	--	Paper #9: Machine Learning
11	11/2	Data Visualization - Virtual Reality and Augmented Reality	--	Paper #10: VR/AR/MR/XR
12	11/9	Life cycle tech solutions for AEC industry	--	--
13	11/16	The Future of Construction Tech: Human-Robot Collaboration; Intelligent Cognitive Assistance; Automation; Additive Manufacturing. Lab visit – robot, VR/AR, neuroimaging applications	HW#4: Essay submission (Individual)	
14	11/30	TERM PROJECT PRESENTATIONS/DEMO		--
15	12/7	FINAL EXAM	Final Presentation file and Report 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#4A: Data Analytics essay OR HW#4B: Visualization essay	100	15%
B	Final Exam	100	30%
C	Weekly paper review	100	5%
	Team projects		
D	HW#1: Facebook timeline	100	10%
E	HW#2: Smart app demo	100	10%
F	HW#3: Smart building design	100	10%
G	Term project	100	20%
H	Peer Evaluation (team members)	1.0	Multiplier
	Final Grade=A *15%+ B*30%+C*5%+H*(D+E+F)*10%+H*G*20%		

HW#1: Facebook Timeline – History of Construction Technologies

1. Form a team of 2.
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, 2021.
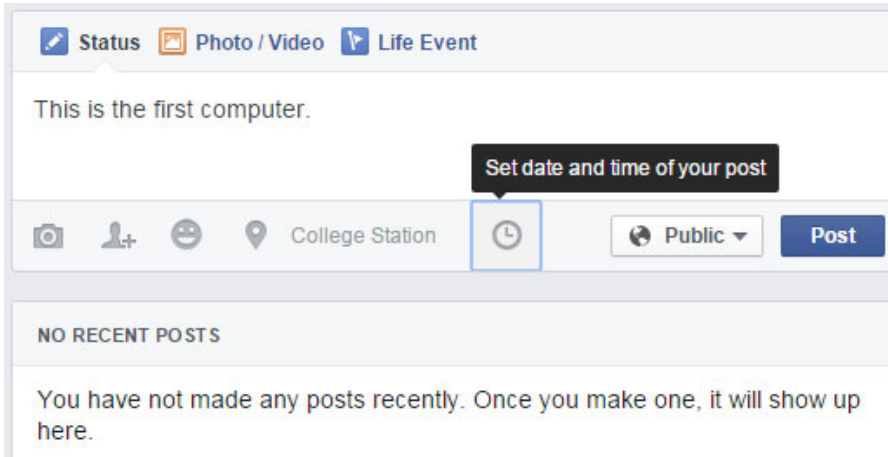
Facebook "ITee" account info
Username: dujing82@gmail.com
Password: CGN6905itcon
5. **Present your findings and initiate discussions (30 minutes) in the class on September 7.**
6. It will be peer evaluated based on: (1) Contents (full length articles; videos, images) – 30%; (2) Relevance and Connection 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.
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. **Demonstrate the app (15 minutes) to the class on September 28.**
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.
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. **Demonstrate the proposal (15 minutes) to the class on October 12.**
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#4A: Essay – Data Analytics in Civil Engineering and Construction (select HW#4A OR HW#4B, just one)

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 words.**
5. **Submit your essay on November 16 end of day.**
6. 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%.

OR:

HW#4B: Essay – Visualization in Civil Engineering and Construction (select HW#4A OR HW#4B, just one)

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 words.**
4. **Submit your essay on November 16 end of day.**
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%.

Term Project (team project)

1. Form a team of 2
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 November 30.**

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:
UF Graduate Catalog
Grades and Grading Policies

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, 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/.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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/process/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
• Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@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: https://counseling.ufl.edu, 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 Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/state-authorization-status/#student-complaint.*