Fall 2024, Smart cities: Growth with Intelligent Transportation Systems
12-645/94-845
Thursdays, 6:40 pm to 9:30 pm, HBH 2008

Instructor: Tao Tao, taot@andrew.cmu.edu
Office Hours: Thursday 4-5 pm, 118Q thesis room in Porter Hall or virtually available by appointment [Starting from October 31st]
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Canvas organizes this course. All course materials will be posted to Canvas (www.cmu.edu/canvas). Discussion board is for you to interact with others in the course. TA and the instructor will check the discussion board at least once every other day, but please plan your time accordingly so questions can be answered in a timely manner. The best way to communicate with the instructor and TA is through emails.

Textbook
There is no textbook for this course. Materials will be posted on Canvas as needed.

Student well-being: Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is almost always helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website thttp://www.cmu.edu/counseling/. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

Diversity and Inclusion: We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the

work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment. Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- Center for Student Diversity and Inclusion: csdi@andrew.cmu.edu, (412) 268-2150
- Report-It online anonymous reporting platform: reportit.net username: tartans password: Plaid

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.

Academic Honesty: As a CMU student, you have agreed to abide by CMU's policies on ethics and discipline, which can be found in http://www.cmu.edu/academic-integrity/. No cheating and plagiarism will be tolerated.

Using information directly from websites, books, papers and other literary sources without appropriate attribution is plagiarism. Assignments submitted for this class will be reviewed by the instructor and TAs and may be scanned through web-based academic integrity software. Occurrences of cheating or plagiarism will be handled according to the university policy on Cheating and Plagiarism, https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html. Students are expected to have read this policy and conform to the highest standards of academic integrity. For incidents of academic misconduct, the University Academic Disciplinary Actions Policy, found at https://www.cmu.edu/student-affairs/theword/academic-discipline/index.html, will be followed.

Artificial Intelligence: AI language models, such as ChatGPT, can only be used to improve writing. Students cannot use AI language models to generate answers and solve problems for their assignments directly. Students who use AI language models to improve their writing should have a clear statement in the final section of their assignments. Students are responsible for fact checking statements composed by AI language models. Unattributed use of AI language models are forms of scholastic dishonesty and will be treated as such.

Course Context

Cities all around the world are being built and re-invented as smart cities utilizing information systems and innovative applications of data analytics. One major smart cities component is transportation. The Intelligent Transportation Systems (ITS) industry is expected to grow at a

rate of 4% per year and reach $37 Billion in annual investment by 2027 (Reportlinker, 2021). This shifting dynamic provides great opportunity for improved transportation safety and efficiency but also poses challenging information systems and public policy challenges. Furthermore, there are new opportunities for professional-school graduates outside of engineering schools for employment in transportation planning and policy.

This course is supported by CMU's Traffic21 Institute and Safety21 National University Transportation Center. Classes will feature guest lectures provided by Traffic21/Safety21 faculty and industry and government ITS professionals.

Course Objectives
- Develop an understanding of the underlying dynamics of the smart cities trend and how ITS is integrated. Smart Cities components in addition to transportation include energy systems, health and human services, water and sewer infrastructure, public safety, etc.
- Develop an understanding of the various components of ITS. Examples of ITS components included: autonomous and connected vehicle technology in vehicles and between infrastructure and vehicles, real-time sensing of infrastructure, artificial intelligence to analyze data, information dissemination, shared mobility services, etc.
- Develop an understanding of the various applications/systems of ITS on the local, state, national and international levels. Examples of ITS applications include advanced traffic control system, automatic road enforcement (variable speed limits, electric toll collection), intelligent public transportation system, transportation demand management, intelligent parking management system, multi-modal traveler information systems, etc.
- Synthesize and analyze ITS policy and understand the technology challenges. Examples of current technology challenges include inadequacy of GPS positioning distribution of safety certificates. Policy challenges include privacy, liability, tax equity, social acceptance of technology, etc.
- Develop hands on experience of ITS concepts by applying them to scenarios such as the City of Pittsburgh's smart transportation plans.

Course Format
Each of the class meetings will focus on a particular topic of ITS. To pursue the course objectives most effectively you will be asked to accomplish the following:
1. Read the assigned article(s) or technical report(s) in advance,
2. Attend guest lectures provided by the instructors, industry and government ITS professionals,
3. Participate in the discussion for ITS issues and case studies,
4. Prepare weekly reflections after each class and turn in by Wednesday midnight,
5. Hand in a final project report and present your project in the end of the course.

Grading

Your course grade will be based on the following team and individual activities and weights:

Team	
Final project (proposal due 15th November accounts for 10%)	50%
Individual	
Four weekly reflections (due on next Wednesday by midnight)	40%
Class participation	10%
Total	100%

Homework Submission Policy: No late homework will be accepted after the due time unless previously arranged with me 24 hours prior to the deadline. At most two additional days will be extended after the arrangement. No extension for final project related assignments.

Participation

Participation is required for this course and accounts for 10% of the final grade. Students should notify the instructor of their absence at least one day earlier before the lecture. At most one day of leave is permitted. Any additional day of leave will account for 2% of the final grade.

Reflection

Students are required to read several pieces of materials related to the topic of the lecture and write one-page reflection on these readings. The readings are available one week before the lecture. The assignment is due by the midnight of the Wednesday right before the lecture.

Final project

All students will be expected to complete a semester project on a topic of their choice in transportation systems. Because you can learn a great deal in this course by working with your fellow students, you are encouraged to work in teams of three or four. Each group would need at least one engineer (or computer scientist) and one policy analyst (or social scientist). For those of you that have trouble selecting a topic, we will brainstorm some ideas in class. In the meantime, you might begin to consider potential topics and groups. Groups will present oral summaries of their work during the last class session and will submit written reports. Each group member will need to present his/her work as part of the group presentation. Each group member needs to evaluate the performance of their group members and submit the evaluation form individually.

Your project needs to address a real-world challenge. Possible project topics include, but are not limited to:
- A critical review of an ITS application with proposed future research framework
- Cost/benefit analysis of an ITS component or application
- A state-of-the-art review of an ITS component or application, and its future development
- How can an ITS component or application be implemented to achieve sustainable mobility?

- How can an ITS component or application help to manage transportation demand efficiently (e.g., congestion pricing, parking pricing)?
- How does an ITS component or application affect the long-term land-use development, urbanization or transit-oriented development?
- Data Analytics and its applications in an ITS to address a specific real-world problem.

Your group may choose to do an in-depth project on any of the above applications. Your group may also develop your own project. A project report is to be submitted by December 8th. The project must include both technology and policy components. Please work closely with the instructors to develop your project ideas if needed.

Appearing below is the grade sheet that will be completed for each project. Make sure your project has all the elements listed.

Item	Possible	Score
Oral Presentation	10	
Statement of Problem/Goal/Background	4	
Literature Review	4	
Research Approach	2	
Analysis	7	
Results	7	
Conclusions	4	
Limitation and Future Work	2	
Total	40	

A one-pager project proposal is due November 15th 11:59 pm. The proposal accounts for 20% of the final project, namely 10% of the course grade. The proposal should have the following elements:

Item	Possible	Score
Statement of Problem/Goal/Background	2	
Expected Research Approach	2	
Expected Results/Outcomes	2	
A list of potential readings and/or data sets	2	
Task description for each group member	2	
Total	10	

Plagiarism
All writings will be submitted to Turnitin to check similarity. The database includes student repository, institutional repository, website content, and periodicals, journals, and publications.

Plagiarism is not related to similarity index. Any similarity longer than 7 words would be potentially considered as plagiarism. Any plagiarism will be treated as academic dishonesty and reported to the University.

Course calendar

Date	Schedule
10/24	**Why Smart Cities, Why ITS, Why Now?**
	• Course overview, Smart Cities overview (6:40-7:10) • Guest lecture and Q&A (7:15- 8:15) o Guest Speaker: Karen Lightman (Safety 21) • Lecture and discussion (8:25-9:30)
10/31	**Autonomous and Connected Vehicles, Applications of V2I and V2V**
	• Guest lecture and Q&A (6:40- 7:40) o Guest Speaker: Zulqarnain Khattak (Morgan State University) • Lecture and discussion: Connected automated vehicles: applications and policies (7:50-9:30)
11/7	**Intelligent Sensing**
	• Guest lecture and Q&A (6:40- 7:40) o Guest Speaker: Christoph Mertz (RoadBotics by Michelin) • Lecture and discussion: Intelligent sensing (7:50-9:30)
11/14	**Travel Demand Management and Traveler Information Systems**
	• Guest lecture and Q&A (6:40- 7:40) o Guest Speaker: Naveen Lamba (Guidehouse) • Lecture and discussion: Travel demand management (7:50-9:30)
11/15	**Term project one page proposal due 11:59 pm**
11/21	**Shared Mobility Services**
	• Guest lecture and Q&A (6:40- 7:40) o Guest Speaker: Rylan Seifert (City of Pittsburgh Department of Mobility and Infrastructure) • Lecture and discussion: Shared mobility services (7:50-9:30)
11/28	Thanksgiving, no class
12/5	**Term project presentations**
12/8	**Term project due 11:59 pm**