PLAN 341

Smart Cities: Concepts, Methods and Design

Credit Hours: (3)

2018/19, Term 2

COURSE INFORMATION

Class Meeting Time: Lecture: Tues. 2 – 3:30 pm Tutorial: Thurs. 2 – 3:30 pm

Location:
Lecture WMAX 110
Tutorial:
0T1 WMAX 110
0T2 WMAX 150

Instructor: Martino Tran

Office Hours:
By Appointment

SHORT COURSE DESCRIPTION

Cities are being rapidly transformed by information technology and socio-economic innovation. This is led by a massive growth in citizen generated data and the internet of things. This class will explore emerging theory, methods and frameworks for understanding "Smart Cities".

Prerequisites:
Third-year standing or above in any program. Second year students may be admitted with permission of instructor.

COURSE FORMAT

This course will be delivered through weekly lectures (3 hrs. per week), key literature readings, out of class analysis of case-studies followed by in-class discussion focusing on student grasp of fundamental concepts, tools and methods. Students will be expected to demonstrate critical thinking and communication of emerging social, economic and policy challenges in the context of transitioning towards more sustainable smart cities. Guest lecturers will contribute domain and methodological expertise. Students will complete assignments focused on technical writing, and group design an urban information technology solution, and present findings as a "Smart City Start-Up Pitch".

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COURSE OVERVIEW

The objective of this course is to provide students with an introduction to the technological and policy challenges and opportunities in the emerging field of Smart Cities. It will begin with a high level policy analysis of current challenges facing cities around the world including population growth, urbanization, social well-being, economic development and climate change.

The course will also provide an overview of key concepts, tools and frameworks to assess the sustainability impacts of smart cities including: urban metrics and indicators, big-data analysis, and applications in urban modelling and simulation. There will be a focus on how data-driven analytics and technological and social innovation can help address urban policy challenges and inform evidence based decision-making.

LEARNING OUTCOMES

After taking this course students will be able to:

- Contextualize the smart city within broader societal/historical context; Understand emerging academic concepts, and policy debates surrounding smart cities;
- Have broad knowledge of the key physical, social, environmental and policy challenges facing global cities;
- Write a technical essay and critically analyze how new information technology, social innovation, and data-driven analysis can contribute to tackling urban challenges;
- Understand key urban metrics and indicators for assessing the sustainability performance of smart cities;
- Understand the application of visualization and simulation techniques for urban policy and decision making;
- Conceptually design a data-driven solution to an urban challenge in the smart city context;
- Work effectively in groups on a design project, communicate and “pitch” a technological data solution to a generally informed audience.

ADDITIONAL COURSE REQUIREMENTS

None

ATTENDANCE

Students are expected to attend all scheduled lectures and tutorials.

EVALUATION CRITERIA

Assignments	Description	Weight
Participation	• Students are expected to complete assigned readings and actively contribute to class discussions; collegial debate, counter perspectives, and constructive criticism are encouraged.	10%
Technical Writing	• Students will complete a maximum 3,000 word essay selecting one class lecture or case-study, and critically analyze the content in-depth demonstrating original thinking and analysis. • Succinct argumentation based on descriptive statistics or other quantitative data is encouraged.	45%
Smart City Design Solution	• Students will collaborate in small teams (3-4) and develop a data-driven design solution to a real world urban challenge. • Students are expected to develop the conceptual design and functional specifications for an information based innovation e.g. a mobile application, web-based platform, modelling and simulation tool, visual analytics, data base solution, etc. • The team will deliver its project summarized in a report (15 pg. maximum) and present to class as a “Smart-City Start-Up Pitch”. The audience will vote on the winner. • The instructor will give the final grade for the project report and pitch presentation. As this is a team-based project, all members of the team will be assessed collectively and given the same mark (except in cases of extreme disparity, where differentiated grading may be required).	45%

GRADING GUIDELINES

UBC courses are graded on a percentage basis. Corresponding letter grades are assigned automatically by the Registrar. (See *UBC Calendar >> Campus-wide Policies and Regulations >> Grading Practices* for additional information.)

Percentage (%)	Letter Grade
90-100	A+
85-89	A
80-84	A-
76-79	B+
72-75	B
68-71	B-
64-67	C+
60-63	C
55-59	C-
50-54	D
0-49	F (Fail)

REQUIRED TEXTBOOKS

None

RECOMMENDED TEXTBOOKS

None

COURSE SCHEDULE

Module 1	Smart City Challenges and Concepts
Week 1	Course introduction and overview
Week 2	Urban challenges in the 21st Century: Readings: • Davis SJ et al. (2010) Future CO2 emissions and climate change from existing energy infrastructure. Science 329(5997): 1330 – 1333. • IPCC (2014) Fifth Assessment Report – Impacts, Adaptation and Vulnerability. Additional resources: UN Habitat is a global resource for various urban initiatives including policy briefs and reports: • Cities and Climate Change: https://unhabitat.org/urban-initiatives/initiatives-programmes/cities-and-climate-change-initiative/ • Smart and Resilient Cities: https://www.smartresilient.com/un-habitat
Week 3	Contextualizing and measuring the modern city Readings: • Bettencourt L et al. (2007) Growth, innovation, scaling and the pace of life in cities. PNAS, 24: 7301 – 7306. • Bettencourt L, West G (2010) A unified theory of urban living. Nature 461: 912 – 913. • Kitchin R (2014) The real-time city? Big data and smart urbanism. GeoJournal 79: 1 – 14. • Thrift N (2014) The promise of urban informatics: Some speculations, Environment Planning A, 46: 1263–1266.
Week 4	Smart city concepts and frameworks Readings: • Batty M et al. (2012) Smart cities of the future. The European Physical Journal Special Topics, 214: 481 – 518. • Jiong J et al. (2014) An information framework for creating a smart city through Internet of Things. IEEE Internet of Thing Journal, 1: 112 – 121. • Lee et al. (2014) Towards an effective framework for building smart cities: lessons from Seoul and San Francisco. Technological Forecasting and Social Change, 89: 80-99.

	• Ratti et al. (2006) Smart cities, big data, and the Internet of Things. IEEEE, 4: 1 – 2. Additional resources: • Wired Magazine has topical updates, interviews, and general reading on Smart City initiatives: http://www.wired.co.uk/topic/smart-cities • The Intelligent Community Forum is a global network of smart cities with additional reports and case-studies: http://www.intelligentcommunity.org/ • The International Organization for Standardization develops indicators and related resources for smart cities: https://www.iso.org/news/2016/07/Ref2103.html
Module 2	**Case-Study Analysis** Each case-study will show the technical challenges and opportunities, and also assess the innovation/technology within the broader societal context including socio-economic impacts, vulnerable populations, data privacy, ethics and security.
Week 5	Case-study 1: Smart Grid Understanding the socio-economic and environmental impacts of infrastructure investment. Readings: • Hickford AJ et al. (2015) Creating an ensemble of future strategies for national infrastructure provision. Futures, 66: 13 – 24. • Baruah P et al. (2014) Energy system impacts from heat and transport electrification. Proceedings of the ICE - Energy, 167(3): 139-151. • Grunewald P, Layberry R (2015) Measuring the relationship between time-use and electricity consumption. ECEEE Summer Study Proceedings, 2087 – 2096.
Week 6	Case-study 2: Intelligent Mobility Understanding the impacts of new technology on equity, accessibility, and quality of life. Readings: • Greenblatt JB, Saxena S (2015) Autonomous taxis could greatly reduce greenhouse-gas emissions of US light duty vehicles. Nature Climate Change 5: 860 – 863. • De Graaff T, Rietveld P (2007) Substitution between working at home and out-of-home: The role of ICT and commuting costs. Transport Res A-Pol, 41: 142–160.

	• Cottrell CD et al. (2013) Future Mobility Survey: Experience in Developing a Smartphone-Based Travel Survey in Singapore. Transport Res Board 92nd Annual Meeting.
Week 7	Case-study 3: Citizen science and open data Understanding the debates around big data, privacy, and security. Readings: • McKenna E et al. (2012) Smart meter data: Balancing consumer privacy concerns with legitimate applications. Energy Policy 41: 807 – 814. • Snik F et al. (2014) Mapping atmospheric aerosols with a citizen science network of smartphone spectropolarimeters. Geophysical Research Letters, 7351–7358. Additional resources: • Citizen Science projects: https://en.wikipedia.org/wiki/List_of_citizen_science_projects
Module 3	**Design, planning and engineering solutions**
Week 8	Applications of simulation and visualization for urban policy Readings: • Alderson D et al. (2014) Visualization tools for multi-perspective, cross-sector, long-term infrastructure performance evaluation. Proceedings International Symposium on Next Generation Infrastructure, Austria. • Keirstead J et al. (2012) A review of urban energy system models: Approaches, challenges and opportunities. Renewable and Sustainable Energy Review, 16: 3847 – 3866.
Week 9	Applications of simulation and visualization for urban policy continued… Readings: • Batty M. (2013) Big data, smart cities and city planning. Dialogues in Human Geography, 3: 274 – 279. • Vespignani A. (2009) Predicting the behavior of techno-social systems. Science 325: 425 – 428. Additional reading (not required): • Trabesinger (Ed.) (2012) Nature Physics Insight – Complexity. Nature Physics 8: 1 – 48

Week 10	Smart City business models – Focus on new technologies Readings: • Bishop JDK et al. (2013) Evaluating the impacts of V2G on the costs of owning and operating electric vehicles and plug-in hybrid electric vehicles. Applied Energy, 111: 206-218. • Perera C et al. (2015) The emerging internet of things marketplace from an industrial perspective: A survey. IEEE Transactions on Emerging Topics in Computing, 3: 585 – 589. Additional resources: • IBM Smart Cities initiative: https://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/
Week 11	Smart City business models - Focus on new partnerships (PPP, G2G, etc.) • Cohen B and Kietzmann J. (2014) Ride On – Business models for the sharing economy. Organization and Environment, 27: 279 – 296. • Santi P et al. (2014) Quantifying the benefits of taxi trips in New York through shareability networks. PNAS, 37: 13290–13294.
Week 12	Smart City Start Up Pitch – Group presentations
Week 13	Smart City Start Up Pitch – Group presentations

SUPPLEMENTARY MATERIALS

UBC has numerous research, pedagogical and health resources available to students. These include The Centre for Teaching, Learning and Technology, the Irving K. Barber Learning Centre, the Writing Centre, Student Health Services and Student Counselling Services. You are encouraged to make use of these resources.

SPECIAL NEEDS

You are requested to inform the instructor as soon as possible if you have special needs and require accommodation of any kind. Please visit http://www.students.ubc.ca/access/ for more information on campus resources.

ACADEMIC INTEGRITY

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences. (See *UBC Calendar >> Campus-wide Policies and Regulations >> Discipline for Academic Misconduct* for additional information.)