

**Title (Units):** **GCAP3065 Design for Smart City: Towards a Sustainable Living (3,1,2)**

**Course Aims:** Cities and communities worldwide are facing complex challenges such as economic pressure, infectious disease, climate changes, ageing and healthcare, energy crisis, pollutions, resource shortage etc. By integrating emerging Information Technology, Business Strategy and User-centric Design, smart city solutions could enhance the liveability, workability and sustainability of our society.

This course aims to develop a group of socially responsible graduates who have a vision of sustainable development and are able to apply technology to do strategic planning and design. Students will learn the concepts, framework and key technologies (e.g. IoT, AI, big data, cloud computing) related to smart cities and how they can be applied to different aspects of the society (e.g. transportation, healthcare, environment, accessibility). They will also learn how to research to understand and leverage related policies (e.g. Hong Kong Smart City Blueprint and the personal data privacy protection laws of different regions), and provide critical and ethical evaluation of the potential barriers and impacts for adopting the concept of smart cities from an interdisciplinary approach. In addition, students will also experience a hands-on training, for example embedded systems programming to help them create prototypes for smart cities solutions. Guided by the Design Thinking methodology, students will develop skills of human-centric design. They will work in groups to co-design feasible smart and sustainable solutions with community partners (NGOs, social enterprises, government offices, etc.) by applying key technologies learnt in this course and relating other knowledge learnt from their Major studies. Those smart solutions may contribute to accelerating one or more goals out of the 17 Sustainable Development Goals (SDGs) of United Nations (UN). In the co-design projects, students can deepen their understanding of sustainability issues and practices, and gain the opportunities to serve the community through field visits, guest lectures, public education or implementation of the designed solutions. Students may also apply entrepreneurship and marketing knowledge to develop service leadership plans or business plans, and promote their plans to be widely implemented in community services.

For example, partnering with one NGO - an elderly care centre, students may take a leadership role to plan and project, first deepen the understanding of the current challenges of elderly care in Hong Kong by field trips or interviews with elderlies, and then lead the NGO staff and elderly participants to co-design smart healthcare solutions to monitor the elderly's health status by applying big data, AI and IoT technologies. This solution may empower the NGO to provide better services to their beneficiaries with limited resources, while enabling the elderly to enjoy better quality of life. The proposal could be implemented in a small scale to prove the concept. The process of working with NGOs could enhance the digital capacity and bring digital transformation to the organizations. This outcome may contribute to the UN SDG number 3: Good Health and Well-being. This group of students may also promote their idea to inspire younger students (e.g. a public demo) or turn their idea to a business practice.

On completion of this course, students develop the sustainable development vision and leadership in strategic planning from aspects of technical, economical, ethical and policy. They may also get prepared to become a change maker and bring social impact to their workplace, community and the World.

**Prerequisite:** Nil

**Course Intended Learning Outcomes (CILOs):**

Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
	<b>Knowledge</b>
1	Explain global/local social challenges/issues and the United Nations (UN) 17 Sustainable Development Goals;
2	Discuss the concepts, framework and key technologies of smart cities, related policies and ethics;
	<b>Skill</b>
3	Develop sustainable development vision and leadership in strategic planning from various aspects including technical, economical, ethical, policy that are related to the student's Major study;
4	Apply Design Thinking methodology and spirit of entrepreneurship to develop and promote smart and sustainable city solutions/services, as well as deliver the solution/service to the beneficiary.

**Calendar Description:** This course aims to develop a group innovative change maker, who has sustainable development vision, be able to do strategic planning and design for smart city solutions, which enhance the livability, workability and sustainability of our society. Students will learn the key technologies (e.g. IoT, AI, big data, cloud computing) and applications related to smart city. Guided by the Design Thinking methodology, students will work in groups to co-design smart and sustainable solutions. Students will also develop skills of human-centric design, and be able to evaluate the feasibility of the solutions considering policy, economy, culture, ethics, etc. Entrepreneurship spirit and marketing skills will be applied to promote those solutions to be widely implemented in different aspects of society (e.g., transportation, healthcare, environment, accessibility, etc.) and serve various groups of community. Those designed smart solutions may contribute to accelerating one or more Sustainable Development Goals (SDGs) of the United Nations (UN), and bring social impact to their workplace, community and the World.

**Teaching and Learning Activities (TLAs):**

CILOs	Type of TLA
1-3	Lectures & Guest Lectures Concepts and key elements of smart city technologies, entrepreneurship and marketing from an interdisciplinary approach.
1	Field Trips/Guest Lectures/Case Studies: Students will observe and experience social phenomena through guided field trips or guest talks, and be inspired by various cases (e.g. Microsoft Seeing AI which makes visual impaired people hear environment around). Students will give presentations of case studies to share the findings. Guest lectures may include academia or industry professionals (such as faculty members from social science, industry professional from transportation sectors, etc.) for interdisciplinary exposure.
1,3,4	Workshops Students will be guided by the Design Thinking methodology to co-design their solution, starting from understanding users, reframing problems, making ideas into prototype, testing and delivering to service beneficiary. They will also have hands-on training, for example Embedded systems for basic prototyping. Students will try to implement the concepts learnt from lectures during workshops. In addition, students will also reflect on the ideas' feasibility from aspects of technical, economical, ethical and policy.
1-4	Group Project (Service Leadership Education Project): Each group of students will work on a real challenge facing by our community (e.g. NGOs, social enterprises, government offices, companies, etc.) to get deeper understanding of the issue, and to design prototypes. E.g. Design smart water meter with Friends of the Earth. In the project, students will take leadership roles to plan for the users studies, co-design workshops, etc.
3-4	Roadshow: Demonstrate the design projects to the public (e.g. students, citizens, policy makers) and promote smart city and sustainability concepts.

**Assessment:**

No.	Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
1	Workshop	30%	1,3,4	In workshops, students will be guided by faculty with design thinking facilitation training, to learn

				<p>the design thinking process, and apply it to a problem.</p> <p>Students will be assessed regarding how skillful they are in using tools in five key design thinking phases (Empathize, Define, Ideate, Prototype and Test). The assessment will focus on whether students can choose the right tools, how well they apply the tools, how the tools can help to accelerate and innovate ideas, how well they build ideas on the other, how well they collaborate, and their interpersonal skills.</p> <p>Students will be assessed how well they implement the concepts learnt from lectures into scenarios. Other than group assessment, student performance such as discussion participation and contribution will be assessed individually by the teacher. Students will also be assessed by their peers via peer evaluation.</p>
2	Project and Demo (Group)	40%	1,2,3,4	Project will be used to assess how deep the students understand the issue they focus, how skilled they apply Design Thinking in problem solving, how well they apply key smart technologies to achieve the feasible plans, quality of proposal, level of implementation, as well as how well they can promote their solutions to the public, organizations and business, how well they collaborate with partners to approach the project, etc.
3	In-class Exercise	20%	1,2,3	Students will work on graded exercises (such as quiz) in class to practice knowledge and skills learnt in the lectures.
4	Case Study	10%	1,2,3	Case study in the format of report or presentation is used to assess students' ability of discovering inspiration from cases, case analysis from various angles (e.g. technology, business, policies, social and ethics), and critical thinking skills.

#### Assessment Rubrics:

<b>Excellent (A)</b>	<ul style="list-style-type: none"> <li>Achieves the first five CILOs, with strong evidence of having achieved the last CILO, demonstrating a good mastery of both theoretical and practical aspects of the knowledge and skills associated with visual analytics and applications</li> <li>Able to develop and present sound arguments and correct solutions to problems, accompanied by in-depth analysis and insight</li> <li>Demonstrates a thorough understanding and solid knowledge of visual analytics concepts, methodologies, and techniques</li> <li>Able to draw on a variety of techniques and relevant knowledge and appropriately apply them to new visual analytics situations and problems</li> </ul>
<b>Good (B)</b>	<ul style="list-style-type: none"> <li>Achieves the first five CILOs, with evidence of having achieved the last CILO, demonstrating a good understanding of the associated concepts and underlying methodologies</li> <li>Able to develop solutions to problems, accompanied by adequate explanations</li> <li>Demonstrates a competent level of knowledge of visual analytics concepts, methodologies, and techniques</li> <li>Ability to make use of appropriate knowledge and techniques and apply them to familiar situations and problems</li> </ul>

<b>Satisfactory (C)</b>	<ul style="list-style-type: none"> <li>• Achieves most of the first five CILOs, demonstrating a basic level of understanding of the associated concepts and underlying methodologies</li> <li>• Able to provide acceptable solutions to problems</li> <li>• Demonstrates an adequate level of knowledge of visual analytics</li> <li>• Ability to make use of some knowledge and techniques and apply them to familiar situations</li> </ul>
<b>Marginal Pass (D)</b>	<ul style="list-style-type: none"> <li>• Achieves some of the first five CILOs, demonstrating a minimum level of understanding of the associated concepts and underlying methodologies</li> <li>• Able to provide marginally acceptable solutions to certain problems</li> <li>• Demonstrates a threshold level of knowledge of visual analytics</li> <li>• Ability to make use of limited knowledge or techniques and apply them to some simple cases</li> </ul>
<b>Fail (F)</b>	<ul style="list-style-type: none"> <li>• Achieves less than four of the CILOs, with little understanding of the associated concepts and underlying methodologies</li> <li>• Unable to provide solutions to simple problems</li> <li>• Knowledge of visual analytics falling below the basic minimum level</li> <li>• Unable to apply knowledge and techniques to situations or problems</li> </ul>

#### Course Content and CILOs Mapping:

Content		CILO No.
I	Worldwide challenges and United Nations Sustainable Development Goals (UN SDGs)	1
II	Smart city and its key technologies	2
III	User-centric design	4
IV	Innovation management	3

#### References:

- Office of Government Chief Information Officer, HKSAR. (n.d.). The Smart City Blueprint for Hong Kong. Retrieved from <https://www.smartcity.gov.hk/>
- Department of Economic and Social Affairs United Nations. (n.d.). Sustainable Development Knowledge Platform. Retrieved from <https://sustainabledevelopment.un.org/>
- Christopher G.M. & Fu. (2020), Smart Cities and Artificial Intelligence: Convergent Systems for Planning, Design, and Operations. first edition, Elsevier
- Michael J. Madison, Madelyn Rose Sanfilippo and Brett M. Frischmann (2023), Smart Cities and Knowledge Commons. Cambridge University Press.
- Gassmann, O., Böhm, J., & Palmié, M. (2019). Smart Cities: Introducing Digital Innovation to Cities. West Yorkshire, England: Emerald Group Publishing.
- Sarsar, M. (2019). The Big Disruption : IoT, Smart Cities, Connected Vehicles, Big Data Analytics: A Practitioner Point of View and Return of Experience (REX) !
- Fateh Belaïd, Anvita Arora (2024), Smart Cities, Social and Environmental Challenges and Opportunities for Local Authorities, Springer
- Lewrick, M., Link, P., & Leifer, L. (2018). The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems. Hoboken, NJ: John Wiley & Sons.
- IBM. (n.d.). Smarter Cities. Retrieved from
- [https://www.ibm.com/smarterplanet/us/en/smarter\\_cities/overview/](https://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/)

#### Course Content:

##### Topic

- I. Worldwide challenges and United Nations Sustainable Development Goals (UN SDGs)

## **Week 1**

Worldwide Challenges and United Nations Sustainable Development Goals (UN SDGs) [Lecture]  
Smart city case studies and Hong Kong Smart City Blueprint [Case Study]

### Reading

Introduction to United Nations Sustainable Development Goals.  
Retrieved from  
<https://sustainabledevelopment.un.org/?menu=1300>  
The Smart City Blueprint for Hong Kong, Office of Government Chief Information Officer, HKSAR. Retrieved from  
<https://www.smartcity.gov.hk/>

## **Weeks 2-3**

Partnership Network Establishment and Project Exploration [Project]  
Design Thinking and Innovation [Lecture/Tutorial]  
Service Design Principle and Practices [Lecture/Tutorial]  
User-centric product and service design [Lecture/Tutorial]

### Reading

An Introduction to Design Thinking PROCESS GUIDE, Design School, Stanford University, Retrieved from:  
<https://web.stanford.edu/~mshanks/MichaelShanks/files/509554.pdf>

## II. Smart city and its key technologies

## **Weeks 4-5**

Key Concept, Framework and Technologies for Smart City – Internet of Things (IoT), sensor, RFID, 5G, smart vehicles, Artificial Intelligence, Big Data, Data Privacy and Security and Cloud Computing in the context of smart city applications [Lecture]  
Workshop: Embedded systems programming workshop and working with sensors

### Reading

Introduction to Smart Cities (First Edition) By Pearson  
- Chapter 2: Urbanization and Sustainable Cities  
- Chapter 5-8: Smart Energy/Governance/Water Management/ Waste Management

Microbit guide: <https://microbit.org/code/>

## III. User-centric design

## **Weeks 7-8**

Workshop/Field Trip/Guest Lecture with Partners: Empathy and Problem Discovery [Workshop/Field Trip/Guest Lecture]  
Workshop: turn design to prototyping [Workshop]  
Workshop: turn prototyping to real business practice and community services [Workshop]

## Reading

Building Smart Cities: Analytics, ICT, and Design Thinking. Boca Raton, FL: CRC Press. Chapter Three: A New Perspective on Smart Cities  
Chapter Five: Design Thinking Applied

## **Week 9**

Smart City Applications in Other Cities (e.g. Singapore, London)  
[Case Study]

Ethics and Discussions in Smart City [Lecture/Tutorial]

## Reading

Ethics of Using Smart City AI and Big Data: The Case of Four Large European Cities

Retrieved from: <https://www.project-sherpa.eu/ethics-of-using-smart-city-ai-and-big-data-the-case-of-four-large-european-cities/>

## **Weeks 10-11**

Service Testing with Users/Partner/ Beneficiary, Get Feedback for Improvement [Project]

## Reading

Design Thinking Bootleg by Hasso Plattner Institute of Design, Stanford University

Retrieved from: <https://dschool.stanford.edu/resources/the-bootcamp-bootleg>

## IV. Innovation management

## **Weeks 12-13**

Project and Demonstration to Public or Schools [Publicity]

## Reading

Talk Like TED: The 9 Public-Speaking Secrets of the World's Top Minds