RESICITIES
Education for Resilient Cities

Course on Risk, safety, economics and planning for smart cities

A FREE course offered in the framework of the project

"Building resilience through education for Sustainable, Collaborative and Smart Cities"

(RESICITIES)

Funded by the
Erasmus+ Programme
of the European Union

A course developed by the University of Stavanger in collaboration with the Czech Technical University in Prague

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Course description

By 2050, up to 70% of the world's population will live in cities. Typically, as cities grow, new stresses - including crime, cybersecurity, water pollution, overcrowding, traffic congestion, climate change – will add increasing pressure on city managers and thus require proactive planning and reactive responses. City planners and technologists from various skill-sets will need to carefully consolidate complex cyber-physical processes in a cost-effective, appropriately managed, and thoughtfully implemented way. In particular, Smart Cities, as physical-digital ecosystems, will rely on complex urban and digital interventions to enable managers to predict, prepare, and respond

toa number of human and natural challenges. Cities must also be prepared to function and rebound when things go wrong, and be adaptable to the known and unknowns.

Indeed, in a digital ecosystem of wireless and interoperable communication technologies, when one system fails, the whole system - including the organizational structures that accompany it -could fail. The future of cities thus cannot be fixed with 'digital Things' alone. Smart Cities require a robust blend of carefully considered physical and digital infrastructures, processes and organizational planning. This is why there is a growing need for multidisciplinary expertise in risk, safety, economics and planning for Smart Cities: understood beyond the "digital fixes," but also the spatial, temporal, political, economic, and societal elements of cities too. In order to combine city planning, sensor networks, and societal security, future planners must therefore have knowledge of both technological and societal conditions that make future cities function to their optimal level.

The target group for this course are students with multidisciplinary backgrounds in planning, civil engineering, risk management, and/or architecture. The modules in this course are oriented to students who want to gain multidisciplinary perspectives into cyber-physical, case-specific manifestations of Smart Cities, with particular emphasis in risk, safety, economics, and planning. After completing the course, students will have knowledge of how to proactively forecast and design Smart Cities with consideration for the safety, security and well-being of their citizens. Such knowledge is required from municipalities, county municipalities, directorates and ministries, consultancies and small and large contractors.

Learning Outcomes

Students who complete this course successfully will be able to:

- Assess the risks, safety, economics, and planning approaches – academic, practically, hypothetically - associated with various cyber-physical approaches to the design and organization of Smart Cities.
- Combine of technological and social science approaches to risk, safety, economics and planning for the protection and integrity of Smart Cities.
- Vocalise, orally and in writing, descriptively and analytically, the complex interrelationships between physical and digital interventions required to address present and future Smart City challenges.
- Work within interdisciplinary project groups and teams, bridging the "divides" between the digital and physical manifestations of Smart Cities, and develop real-world professional competencies in this regard.
- Utilize and apply multidisciplinary theoretical perspectives on how damage prevention, damage limitation, crisis management and spatial planning are considered through planning and organizational processes.

- To acquaint students with the issues of reliability and safety of artificial systems and human impact on systems, and reliability diagnostics of ITS technology and equipment with a focus on new methods and models for verifying equipment, technologies and subsystems in road, rail and air transport.

Learning mode

This course is now offered on an ongoing basis entirely online through the innovative Pocket Learning app Ryze (https://ryze.org.uk/). Registered students can download the app FREE of charge and will receive the passwords to claim all modules of this course in their Ryze library of courses. The modules of this course available through Ryze app are composed by nicely designed content with recorded lectures in embedded videos and self-assessment assignments.

Certificate of conclusion and ECTS credits

The postgraduate students who will accomplish the course successfully will be awarded with a certificate issued by the Czech Technical University. The amount of study hours required on students is equivalent to a course that usually awards 2 ECTS.

Theme: Scales and Complexities of Smart Cities

Module 1: Introduction to Risk, Safety, Economics and Planning in Smart cities

Lecturers: Harald N Røstvik, Tegg Westbrook

The challenges to smart cities are always fluctuating, whether that is climate change, road congestion, crime, or recently pandemics. This module will focus on “traditional” safety and security-specific, market/consumer-driven agendas of smart places (homes, businesses and cities). From here the lecture will concentrate on how the Covid-19 pandemic has recently reconfigured our understandings of risk, safety, economics and planning for smart cities, including the human condition. We will consider new ideas and technologies for future cities and regions and, through examples, try to analyse potential for improvement of the human condition.

Compulsory introductory readings will be assigned and addressed in this module. Lecturers will invite students to debate the texts.

Theme: Smart infrastructure planning

Module 2: Measuring the built environment

Fabio Hernández-Palacio

The rise of information technologies has witnessed enormous development in the last decades. Advances in data collection, storage and analysis open new possibilities for

studying urban form and its performance. The built environment is a very complex system made up of cities and the infrastructures that connect them. The configuration of the built environment influences both the economic efficiency of an urban system and its inhabitants' health and quality of life. The urban form also affects resource usage efficiency, such as energy, space, and time, essential aspects of planning for sustainability and resilience. The lecture and short seminar will focus on and measuring the built environment, in particular, how the built environment can influence sustainability, looking at different aspects such as urban quality, urban form, urban density, densification and transportation in relation to Smart Cities.

Theme: Cyber-physical safety and risk in Smart Cities

Module 3: Threats and risks in digital systems

Tegg Westbrook

Smart cities are increasingly relying on surveillance and geospatial services to enable efficient functioning of basic services, adding further complexity to already vulnerable cyber-physical functions. If such services are disrupted, so too are many public and private functions. The lecture and seminar focus on the security and safety dilemmas in relation to digital systems, and the consequences this has for Smart City functions, in terms of economic, social, and political impact.

Theme: Societal and organisational approaches to risk in Smart Spaces

Module 4: Vulnerabilities and risks in cyber-physical systems – an organizational perspective across safety and security

Kenneth Arne Pettersen Gould

Critical infrastructures in cities and their surrounding regions are to an increasing extent developed into cyber-physical systems (CPS), where computers, sensors and networks monitor and control physical processes, with feedback loops where physical processes affect computations and vice versa. The risks that arise from the development of CPS lie at the intersection between the domains of security and safety. This module introduces socio-technical developments that have contributed toward a wider and multidisciplinary foundation for understanding and managing worker- and organization-related risks. It focuses on a socio-technical understanding of causes and embraces the interrelatedness of technical, human and organizational factors for theorizing accidents and disasters. A socio-technical system approach substitutes individualized and general models of human action and error with descriptions of complex and adaptive realities involving a wide range of individual, technical, organizational and systemic factors.

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Module 5: Societal and organisational approaches to risk – an introduction to risk governance

Ole Andreas Engen

This module introduces risk governance and the IRGC Risk Governance Framework, exploring applications to Smart Cities. The lecture takes as a starting point that holistic cyber security management depends on cross-sectoral coordination, communication, cooperation, and knowledge sharing among the actors directly and indirectly responsible for security in critical infrastructures.

In the lecture we will emphasise that the dual nature of the risk concept – i.e., both as potential for physical change and as a social construct - requires a two-sided risk management strategy. Public values and social considerations act as driving forces in identifying the issues where risk analysis is considered necessary or desirable. Hence the opportunities and risks associated with modern technologies, economic development and other human activities requires a pluralistic and integrated model with both technical and social science perspectives.

The term 'risk governance' involves the translation of the substance and core principles of governance to the context of risk-related decision-making. Risk governance does not only include a multi-player risk process with many different aspects, but also considers contextual factors such as: Institutional arrangements - law and regulatory frameworks that determine the relationships, roles and responsibilities of stakeholders, and coordination mechanisms such as markets, incentives, or self-imposed norms. Political culture is also an important variable, including various risk perceptions.

Theme: Intelligent transport and sensor networks

Module 6: Safety and reliability of ITS systems

Tomas Tichy

To acquaint students with the issues of reliability and safety of artificial systems and human impact on systems, and reliability diagnostics of ITS technology and equipment with a focus on new methods and models for verifying equipment, technologies and subsystems in ITS. Basic concepts of safety and reliability in transport and its application. Basic scheme and types of diagnostic systems, including reliability diagnostics of technological equipment and ITS. Investigation of the area of optimization algorithms and fault analysis ETA, FMEA in tunnel system as ITS. Information about HMI in ITS, including operator testing and behavioural in real situations.

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Module 7: Sensors and Sensor Networks

Vaclav Jirovsky

The module is focused on the technology of sensor networks, sensors and used communication technologies with special attention on the security of data collection, data fusion and processing. It deals with the principles and use of sensors of electrical and non-electrical quantities, interfaces for sensor interconnections and communication technologies for sensor networks. Analysis of security of electronic toll collection is provided as an example of sensor network.

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