2SC7290 – Smart cities: connected cities

Instructors: Mohamad Assaad
Department: DOMINANTE - SYSTÈMES COMMUNICANTS ET OBJETS CONNECTÉS
Language of instruction: ANGLAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 80
On-site hours (HPE): 48,00

Description
The projects are centered around practical applications of optimization (combinatorial, convex) and game theory to the current problems of smart cities. The projects will be multidisciplinary and will serve to put into perspective the courses of ST7 and to introduce students to engineering problems and/or scientific research in the field. Examples of projects: gathering and routing of data in smart cities, route optimization for cycling, optimisation strategies for charging bikes at station, electrical consumed energy forecasting, etc.

Quarter number
ST7

Prerequisites (in terms of CS courses)
Communication networks (basics), optimization, Matlab

Syllabus
Examples of projects: gathering and routing of data in smart cities, route optimization for cycling, optimisation strategies for charging bikes at station, electrical consumed energy forecasting, etc.
The practical context of the project is related to a precise service in smart cities (information gathering from sensors, temperature regulation, video surveillance, consumption of electric energy, route optimization for cycling, etc.) and it will be given as a complement to the courses. Students will propose and implement convex optimization or game theory algorithms seen in the courses. They will then test their approaches on potentially in real data.

Class components (lecture, labs, etc.)
Each project is assigned on average to five students and is mainly supervised by a professor. Some projects are jointly proposed with some industrial partners and are hence co-supervised by engineers from these companies. A room dedicated to the projects will be available to students. The supervisors will follow up regularly (one meeting / group / week at the

beginning and one daily meeting per group during the final week). Inter group collaboration will be encouraged (whenever it is possible), and students will be assessed on their ability to work in teams (leadership, tasks' sharing, communication).

Grading
report to write+defense (per group)

Resources
software to use: Matlab

Learning outcomes covered on the course
At the end of the project the student will be able to:

1- know emerging problems in smart cities (telecommunication networks, routing of data, smart charging, etc.)
2- model a network in the context of smart cities with its main functions
3- formulate emerging problems in smart cities as optimization frameworks
4-implement convex optimization and game theory methods in Matlab

Description of the skills acquired at the end of the course
C1 : Analyse, design and implement complex systems made up of scientific, technological, social and economic dimensions.
C1.1 : Examine problems in their entirety and beyond their immediate parameters. Identify, formulate and analyse the scientific, economic and human dimensions of a problem
C1.2 : Develop and use appropriate models, choosing the correct modelling scale and simplifying assumptions when addressing a problem
C1.3 : Apply problem-solving through approximation, simulation and experimentation. / Solve problems using approximation, simulation and experimentation
C1.4 : Design, detail and corroborate a whole or part of a complex system.
C1.5 : Bring together broad scientific and technical concepts in a core structure contained within the framework of an interdisciplinary approach.
C2 : Acquire and develop broad skills in a scientific or academic field and applied professional areas
C2.1: Thoroughly master a domain or discipline based on the fundamental sciences or the engineering sciences.
C2.3 : Rapidly identify and acquire the new knowledge and skills necessary in applicable / relevant domains, be they technical, economic or others.
C3 : Act, engage, innovate within a scientific and technological environment
C3.1 : Be proactive and involved, take initiatives
C3.2 : Question assumptions and givens. Overcome failure. Take decisions

C6 : Thrive in an international and multicultural environment
C6.1 : Identify and use the necessary software for one's work (including collaborative tools) and adapt digital responses according to the context.
C8 : Lead a team, manage a project
C8.1: Work collaboratively in a team.
C8.2 : Train and motivate a group, demonstrating effective leadership.
C8.4 : Work using project management techniques appropriately tailored to the situation.
C9 : Think and act as an accountable ethical professional
C9.2, : Identify, within a given structure, the scope of liability as well as socio-ethical and environmental responsibilities.
C9.4 : Demonstrate rigour and critical thinking in approaching problems from all angles, be they scientific, social or economic.