

Smart City
Techniques
Smart mobility
Energy and water
Urban Applications

NEO Networking and Emerging Optimization **2016**

Intelligent Systems for Smart Cities

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Smart cities: unique features

Welcome to TheSmarterCity | Watch the documentary | Watch the TV spot



- HOLISTIC
- TECHNOLOGY
- INFORMATICS
- TELECOMS
- MULTIDISCIPL.
- CITIZENS
- MANAGERS

Introduction | Healthcare | Education | Traffic | Airports | Rail | Energy & Utilities | Social Services | Public Safety | Retail | Communications | Economic Development!



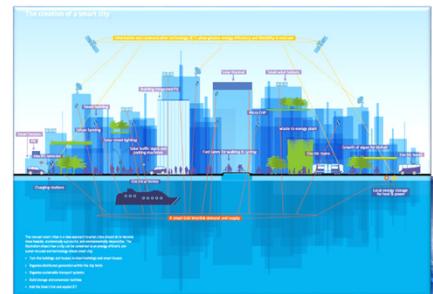
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Many views: potential targets

THINK BIG



THINK SMALL



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Many views: applications and infrastructure

FOCUS ON ARQUITECTURE



FOCUS ON SERVICES

SENSORS AND CITIES

SMARTER OPERATIONS: Data from sensors can be analyzed and used to operate more efficiently and effectively. Data from sensors can be analyzed and used to operate more efficiently and effectively.

BIG BUSINESS: To handle 50 billion sensors by 2020, the market will need to grow 10% per year.

SENSOR-BASED APPLICATIONS: Sensors can be used to monitor and control traffic, energy, water, waste management, and other services.

CITIES WITH SENSOR-BASED SOLUTIONS: Sensors can be used to monitor and control traffic, energy, water, waste management, and other services.

ECONOMIC POWER: Sensors can be used to monitor and control traffic, energy, water, waste management, and other services.

POPULATION CENTERS: The world's population is projected to grow from 7.3 billion in 2015 to 9.7 billion by 2050. The market will need to grow 10% per year.

SHRINKING WORKFORCE: The world's population is projected to grow from 7.3 billion in 2015 to 9.7 billion by 2050. The market will need to grow 10% per year between 2016 and 2025.

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Many views: institutional in Europe

- Eleven priority areas defined in the Strategic Implementation Plan of the European Innovation Partnership on Smart Cities and Communities:
 - Sustainable Urban Mobility
 - Sustainable Districts and Built Environment
 - Integrated Infrastructures and processes across Energy, ICT and Transport
 - Citizen focus
 - Policy and Regulation
 - Integrated Planning & management
 - Knowledge Sharing
 - Baselines, Performance Indicators & Metrics
 - Open data governance
 - Standards
 - Business Models, Procurement and Funding
- For the time being, 8 of the 11 priority areas are covered by the Action Clusters

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Many views: IT and intelligence

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Smart cities: challenges

Unique features mean unique challenges:

- Large scale, every is really big
- Time consuming and real time
- Dynamic, everything changes in time
- Uncertainty in all tasks and phases
- Complex relations, interdependences
- Several goals at the same time
- Human preferences and interfaces
- Lots of restrictions (legal, technical...)
- Mobile plus desktop applications

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Bioinspired techniques and more

- Research in biologically inspired techniques applied to complex problems
- Focus on any technique helping to get efficient and accurate results
- Even advanced methods cannot deal with complex instances of real problems: high dimension, constraints, epistasis, uncertain data, real time, ...
- Traditional methods put so many constraints and simplifications to the problem (in order to solve it) that the found solution is no longer valid

METAHEURISTIC

- Heuristic: information or procedure used to guide the search of algorithms
- Meta: high level structure containing operators later tailored to problems
- Many scientific fields involved: computer science, and also mathematics, operations research, industrial engineering, physics, ...

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Metaheuristic versus the rest of solvers

How they work

What this means

Exhaustive

Advanced

Metaheuristics

Others cannot...

MetaH CAN!

Classic Techniques

Metaheuristics

Advanced

efficiency

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Efficient, accurate, and even Nature-inspired!

Evolutionary Algorithms

Survival of the fittest

Bio-inspired Computing

EA

Inspiration

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...but all of them run in a computer as programs

ACOMetaheuristic ScheduleActivities

```

procedure ACOMetaheuristic ScheduleActivities
    Solutions
    ConstructAntsSolutions
    UpdatePheromones
    DaemonActions // optional
    end ScheduleActivities
end procedure

```

Global best

Convex Combination Metric Space

New position

Best known

(0,2;-1,4;3,5)

(1,0;10,3;7,2)

(1,7;0,3;2,1)

→ Solution Vector

→ Standard Deviation

→ Search Angles

Inspiration

Present Solution

New Solution

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Advanced techniques needed

- Four main ways of upgrading in efficiency and accuracy:

- **Parallelism:**
Clusters, Cloud computing, multicores, FPGAs, GPUs...
- **Hybridization:**
Combining algorithms, operators, representations: problem knowledge
- **Multiobjective:**
Modelling explicitly several conflicting objective functions with Pareto's concept of dominance
- **Dynamism:**
Solve a problem that changes in time and adapt previous solutions to the new scenarios

Applications

Natural Advanced Solutions

Techniques

Bioinformatics

Software Testing

Wind Farm Design

Vanets and Traffic

Parallelism

Multi-objective

Dynamic

Hybridization

Ant Colony Optimization

Particle Swarm

Evolutionary Algorithms

Input layer

Hidden layer

Output layer

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Multidisciplinary experience is common here

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Scientific success reported in journals...

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Companies and city administrations are deeply involved

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Applications (I)

Smart Mobility

<http://roadME.lcc.uma.es>

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Smart semaphores control: approach

- A software tool for the control center, using a bio-inspired engine, to assist the experts on the [semaphore scheduling](#), for a given urban area or the whole city
- By means of [simulation](#) and other software facilities used in the Traffic Control Center of the city, we can generate optimized traffic schedules and efficient strategies of smart mobility for semaphores
- Optimized schedules can then be later applied to [real traffic management](#), after verification tests with such a simulated program (off-line plus on-line)

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The slide illustrates several smart city technologies:

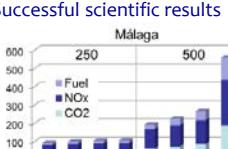
- Smart semaphore control:** A screenshot of a simulation interface showing a road with traffic lights. A red dashed box highlights a specific light, with a callout showing its configuration: "id:logic id=1", "type: 'Traffic light'", "programId: 1", "offset: 0".
- Instance add and Configuration:** A box containing XML-like configuration code for traffic lights.
- Database Encoding:** A diagram showing a sequence of binary digits representing a solution, with a note: "Database Encoding: give a SUMO instance, all the regions with their regular and irregular shapes are encoded in each solution".
- Solution a particle position for the PSO algorithm:** A map of a city street network with a red dot indicating a specific location.
- Particle Swarm Optimization:** A visualization of a particle swarm moving through a 3D space.
- Visualizations:** A grid of six images showing different views of a city area: Google Map view, OpenStreetMap view, 3D city view, Bounding Boxes - Google Maps, Heatmap - Google Maps, and Heatmap - Street View.

Smart semaphore control: results

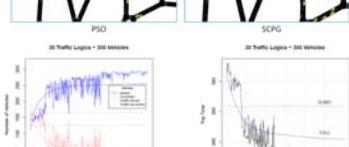
- Optimized semaphore schedules have **benefits** in terms of:
 - Traffic congestion control
 - Prevention of severe traffic jams
 - Reduction of CO₂ emissions and fuel consumption
 - Driver/pedestrian safety
- A tech/tech combination
- Successful scientific results**



Malaga



Scenario	Fuel	NOx	CO2
PSO(250)	~100	~10	~10
DE(250)	~150	~10	~10
PA(250)	~150	~10	~10
RAN(250)	~150	~10	~10
SCPG(250)	~150	~10	~10
PSO(500)	~250	~10	~10
DE(500)	~250	~10	~10
PA(500)	~250	~10	~10
RAN(500)	~250	~10	~10
SCPG(500)	~250	~10	~10
PSO(500)	~350	~10	~10

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Smart Red Swarm: approach

- Smart road traffic optimization to avoid traffic jams and manage the city
- Red Swarm Spots have computation and comm. abilities (infrastructure)
- Vehicles use onboard units, smartphones or tablets
- It distributes traffic based on the probability of congestion: citizen-city balance
- Customized service for every driver
- First design, then use in real time
- Routes is just one use
- Other uses involve big data apps:
 - collecting info from passing vehicles
 - create math models of the city
 - off plus on line merged management



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Smart Red Swarm: arquitecture

The diagram illustrates the Smart Red Swarm architecture. It starts with a 'Configuration' step (CENTRALIZED) where a person uses a laptop to input a map of Málaga. This leads to an 'Evolutionary Algorithm' (OFFLINE) which includes 'SELECTION', 'RECOMBINATION', 'MUTATION', 'EVALUATION' (using SUMO), and 'REPLACEMENT'. The algorithm produces a 'Red Swarm Configuration' (ONLINE). This configuration is then used by a 'Red Swarm Spot' (DISTRIBUTED) to manage a 'Vehicle with an OBU'. A 'Rerouting Algorithm' is also involved in this distributed phase.

An evolutionary algorithm searches for a configuration for the Red Swarm spots

The configured Red Swarm spots are deployed in junctions of the city

GOAL: smart mobility
Reduce travel times, gas consumption, and pollution

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Smart Red Swarm: technical details

MÁLAGA (SPAIN)

- Real Scenario
 - 261 traffic lights
 - 10 Red Swarm spots
 - 800 vehicles
 - 4 vehicle types
 - 3 different traffic patterns (Scen1, Scen2 & Scen3)

Sedan **Van** **Wagon** **Transport**

Our goal is to reduce the travel time of the vehicles in high density conditions, and then pollution

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Smart Red Swarm: some results on travel times

Three line graphs show travel time (Seconds) vs. Number of Vehicles (40 to 800) for three traffic scenarios: 543 vehicles, 360 vehicles, and 4021 vehicles. Each graph compares Expert's Solution (blue line with circles) and Red Swarm (red line with squares).

Show videos...

It works in unseen scenarios

Red Swarm reduces travel and waiting times

Expert's Solution vs. Red Swarm (Avg. values)

Metric	Expert's Solution (s)	Red Swarm (s)	Red Swarm % Reduction
Waiting time (s)	~100	~85	~14.2%
Travel time (s)	~400	~350	~4.2%
Route length (m)	~1000	~940	~5.6%

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Smart Red Swarm: ecofriendly results

Four bar charts compare Travel Time, CO2, HC, PM, NO, and Fuel consumption for Paris, Berlin, Stockholm, and an EU average. The charts show results for 'Experts' Solution' (blue bars) and 'Red Swarm' (red bars). Percentage reductions are indicated for each metric.

City	Travel Time	CO2	HC	PM	NO	Fuel
Paris	8.9%	11.6%	3.8%	5.1%	3.9%	3.8%
Berlin	13.9%	12.2%	4.8%	14.9%	7.9%	4.8%
Stockholm	17.9%	16.1%	7.1%	16.7%	10.2%	6.8%
EU	-	-	-	-	-	-

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Vehicular Ad-hoc Networks: how to comm in cities?

- Communication and computation are the bases for smart cities
- Wireless communications are preferred (flexible, ubiquitous...)
- All communications rely on broadcasting and routing protocols
- Existing protocols do not work in VANETS: new and tuned ones are needed
 - (i) **V2V:** vehicle to vehicle
 - (ii) **V2I:** vehicle to infrastructure

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Optimizing communication protocols in cities

- VANET Protocol Optimization:**
 - VANET communications imply: highly dynamic topology, limitations in coverage, bandwidth, and energy consumption, network congestion, frequent disconnections, and others...
 - An optimal configuration of the communication protocols can improve the quality-of-service (QoS) of the network: a must in this domain
 - Using intelligent automatic techniques to face the huge number of possible protocol configurations

AODV RFC 3561

Parameter	Default Values	Range
ACTIVE_ROUTE_TIMEOUT	3.0 s	1.0 ... 10.0
ALLOWED_HELLO_LOSS	2 HELLO packets	1 ... 10
MY_ROUTE_TIMEOUT	2.0×ACTIVE_ROUTE_TIMEOUT	1.0 ... 10.0
NET_DIAMETER	35 nodes	1 ... 50
NODE_TRAVERSAL_TIME	0.04 s	0.01 ... 1.0
NET_TRAVERSAL_TIME	2.0×NODE_TRAVERSAL_TIME	0.01 ... 10.0
RREQ_RETRIES	3	1 ... 10
RREQ_RATELIMIT	10.0 kbps	1.0 ... 10.0
TTL_START	1.0 s	1.0 ... 10.0
TTL_INCREMENT	2.0 s	1.0 ... 10.0
TTL_THRESHOLD	7.0 s	1.0 ... 20.0

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Optimization by using simulators fed with real data

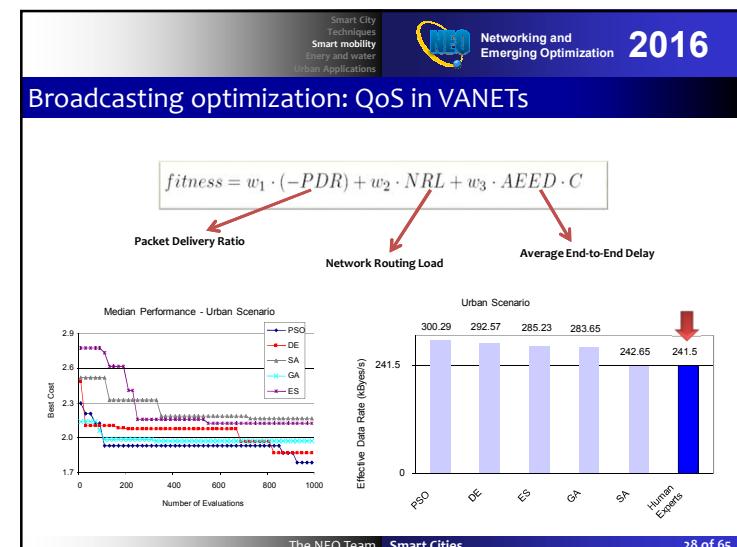
Optimization Algorithms

- Natural Advanced Solutions
 - Ant Colony Optimization
 - Particle Swarm Optimization
 - Genetic Algorithms
 - Others ...

Solution Evaluation

New solution/configuration → Protocol configuration → Ns-2 VANET simulation → Fitness evaluation → Communication metrics → Optimize and then deploy (iterated)

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Green communications: optimizing energy

fitness = energy_consumption

Scenario	Routing (Joules)	CBR/MAC/PHY (Joules)
Scenario U1	~3500	~500
Scenario U2	~4500	~1000
Scenario U3	~8500	~1500
Scenario U3	~9000	~1500

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Real world tests

- From simulation to real world results:
- The real world test results confirm the (ns-3) simulated ones

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Smart panels (I)

- Smart panel services are needed to advise users on the path to reach major places in town, minimizing travel time, fuel consumption, and noise
- The advises are available in information panels at strategic points in the city: traffic lights, parking lots, stop signals, etc.
- The system takes into account traffic state and future predictions, CO₂ levels and noise level

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Smart panels (II)

- Benefits for the citizen:
 - Save driving time
 - Avoid traffic jams
 - Saves fuel
- Benefits for the city:
 - Reduce traffic jams
 - Reduce CO₂ emissions
 - Save energy (fuel)
 - Reduce noise pollution

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Smart bus scheduling (I)

- The generalized utilization of the **smart cards** in city buses and new services of free transfer between buses allow to gather a lot of **interesting data**: more common transfers, rush hour per line, ...
- Applications could allow to **use all those data** to generate a **better flexible scheduling** of buses lines, doing an optimal utilization of the available fleet of buses



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Smart bus scheduling (II)

- The scheduling generated by the proposed application is **flexible** and it also allows to **small changes** (few minutes) in the departures of the buses to **adjust** their scheduling to the **current situation**. For example:
 - Quite a number of passengers (mainly students) of lines 20 and 22 do a transfer to line 5. The scheduling of line 5 can be online tuned (only a few minutes) if a delay is detected in lines 20 or 22
- 
- A small delay in line 20 will ask for a small delay in the departure of buses in line 5 and help bus transit
- Customized **new services** for sharing vehicles or for getting on the fly demands for home pick up and delivery

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Smart EV management

- Electrical vehicles (EVs) have a **reduced autonomy and battery**. Tools for quick reaching/location a station are needed (traffic jams, unexpected events)
- Smart phone applications** are needed to locate nearest charging stations considering time, prices, queues of early clients and citizen's preferences



The slide features a blue header bar with the text "Smart City Techniques", "Smart mobility", "Energy and water", and "Urban Applications". To the right is the logo for "Networking and Emerging Optimization" (NEO) with the year "2016". The main title "Smart surface parking (I)" is in large white font. Below the title is a bulleted list of benefits: "Smart parking services provides drivers with real-time information about parking availability according to a given destination", "Parking rates are adjusted according to the parking availability (flexible pricing)" (with a sub-point "- Reducing the prices in the areas with more free parking places"), and "Allows mobile payment". To the right is a screenshot of a smartphone displaying a map-based parking app with icons for available and reserved spots. At the bottom left is a photo of a woman using a kiosk to pay for parking. On the right is a diagram showing a street with cars and parking meters, illustrating how sensors detect available parking spaces.

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Smart surface parking (II)

- Benefits for the citizen:
 - Make finding and paying for parking faster and easier
 - Find the parking place anywhere with smartphones
 - Save driving time, and therefore, transport time
 - Avoid dangerous traffic situations
- Benefits for the city:
 - Distribute road users through different parking areas
 - Improve business by easing the parking
 - Reduce traffic jams
 - Reduce CO₂ emissions and noise pollution

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Smart signs

- Everything is better with WiFi!
- Policemen near to you, ask for help

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Applications (II)

Energy, buildings and much more

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Smart energy systems

- Energy applications: generation, transportation, forecasting, and consumption
- Tremendous importance for companies, cities, and users!

Wind Farm Design

Disaggregation and Savings

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Smart lighting (I)

- Smart Lighting manages the city lights in order to **reduce the energy consumption**. It gives the correct illumination intensity for the city in an adaptive, collective, and intelligent way

Benefits:

- Reduce energy consumption**
 - public lighting represents between 40% and 70% of the electricity bill of municipalities
- Increase lifetime of city lights**
 - a 5% reduction in operating voltage will more than double the life of a traditional bulb
- Minimizes light pollution**
- Join the green revolution!**
 - the least polluting energy is the one that is not used



- Requirements: few sensors and connectivity to city lighting

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Smart lighting (II)

- Sensors detect the ambient lighting in different areas of the city. Public lighting **adapt its intensity as needed**
- Intelligent management of public lighting has a huge impact in energy consumption, **saving a lot of money**
- Málaga has **239 LED street lamps**, with seven different technologies. The challenge is to fine tune their parameters to **improve efficiency**



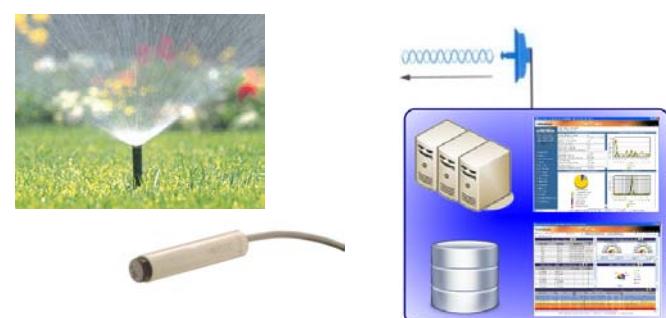
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Smart water jet systems (I)

- This smart garden watering system **improves gardening activities** in the city by **minimizing the waste of water**



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Smart water jet systems (II)

- It **saves water** by sensing the humidity of gardens
- It chooses **the best moment of the day** depending on the water pressure, temperature, etc.
- The optimizations of resources is based on **swarm intelligence technologies**
- It keeps a **record** of the activities to **report** the amount of water saved
- It can be **easily integrated** in the existent facilities of the city



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Smart residuals gathering (I)

- New services for the **optimal planning route** to collect all trash containers in a city. You will know whether the **trash containers** are full and **when** they should be gathered
- Benefits:
 - Clean city (many millions of euros savings)
 - Save in unnecessary collection visit
 - Less noise in our streets
 - Less bad smells
 - Avoid traffic jams (use of traffic information)
 - Service: "Pay as you throw"
 - Only Need: GPS, RFID, and sensors
 - Recycling **creates four jobs** for every one job created in the waste management and disposal industries

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Smart residuals gathering (II)

- With WSN and RFID tags you **can monitor the trash**. The central system receives petitions when the on-site gather is required (⚠)
- With Optimal Routes you will **save money**, time and avoid contamination. Avoid the collection of 2 trash containers means 3.3 km less in this route

Traditional Route: 5.3km Optimal Route: 2km

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Smart building construction: the approach

- Safer, sustainable, modern design principles
- Complex simulations needed
- Optimization and machine learning needed

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Smart building construction: techniques and technologies

PROJECT	REFERENCE	COOLING	HEATING	TOTAL	PERCENTAGE COOLING	PERCENTAGE HEATING	LIMIT	
CASE 1 NO SHADOWS	43,210	42,810	336,210	57,000	41,282	36,728	71,345	53.42%
CASE 2 NO LOGS JUST PROJECTIONS	46,129	53,458	97,587	57,000	41,282	56,288	80,576	52.45%
CASE 3 25% LOGS SHADOW RATE	49,130	84,564	88,214	57,000	41,282	86,288	94,876	50.00%
CASE 4 50% LOGS SHADOW RATE	52,131	94,241	93,431	57,000	41,282	92,431	100,631	47.27%
CASE 5 50% LOGS SHADOW RATE	57,493	76,406	83,899	57,000	41,282	86,288	100,895	43.37%
CASE 6 75% LOGS SHADOW RATE	62,352	22,896	85,248	57,000	41,282	86,288	100,086	50.40%
CASE 7 100% LOGS SHADOW RATE	67,213	19,585	86,936	57,000	41,282	98,288	127,780	46.96%

ENERGY DEMAND ANALYSIS (kWh/sqm)

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Smart tourism (I)

- Smart Visit offers to city visitors a **self-adaptive city trip planner** that improves tourist experience
- The recommender system considers the **users profile** and **up-to-minute sights information** (queue timeouts, remaining capacity, ...) in order to compute the travel itinerary that best fits the visitors at that precise moment
- The traveler can select the **most convenient tour** from the ones proposed by the application. This tour will be rated by the user in order to update and improve the recommender system

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Smart tourism (II)

- Benefits for the city:**
 - City sights are **not overflowing** with people
 - Authorities gather **real-time visitors satisfaction** information
 - Increasing tourist's satisfaction**
- Benefits for the city visitors:**
 - Save tour times avoiding **long queues**
 - Never get lost** thanks to the GPS
 - Multilingual and multimedia **sights description** and events information
 - Increasing safety** avoiding tourist traps

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Smart QRInfo (I)

- Smart QRInfo allows new visitors to easily access to **detailed city information** in the context of where they are located
- QR-Code panels** distributed in interesting points throughout the city can be captured by smartphones to directly serve information to the user with just one “click”
- A **central web service** will redirect dedicated links to real time information:

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Smart QRInfo (II)

- With Smart QRInfo it is possible to redirect visitors' smartphones to official web sites, applications, and voice messages in a straightforward way
- The **central service** will gather and generate **statistic information** for a decision making process, such as: most visited links, sequence of captured QR-Codes in the city, the nature of demanded information...
- Voice messages delivering to blind people
- Low cost implementation:** a minimum infrastructure is required

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Smart monitoring (I)

- Smart measuring and surveillance of city spots

Drones equipped with sensors can take images or capture data to be processed in a control center and then take actions

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Smart monitoring (II)

- Benefits:
- Support to decisions by taking data from the city
- Precise information of weather and environmental conditions
- Better weather forecast in the city
- Garbage in streets, beach...

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Smart hawkeye (I)

- Smart building hawkeye allows the remote damage analysis of buildings and large structures
- Drones equipped with cameras can help detecting any cracks in the wall
- Different sensors can take additional accurate measures at precise points (temperature, humidity,...)
- Proprioception, swarm intelligence, autonomous control...

Different measurements

Building and structures analysis by authorities

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Smart hawkeye (II)

- Benefits:
- Precise information of the building status
- Working safer for technicians responsible for civil assessment
- Avoiding traffic jams caused by the use of large crane trucks

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#RESOURCES

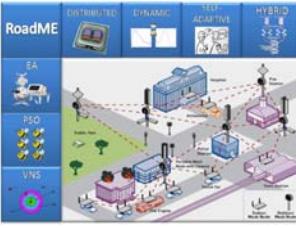
Networking and Emerging Optimization 2016

Some projects: vehicular communication networks

 <http://roadme.lcc.uma.es>

New techniques: from theory to practice

At a glance

RoadME 

Real life testing 

Smart Cities

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#RESOURCES

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Some projects: intelligent applications

 <http://maxct.lcc.uma.es>

C T P A T H 

- App for drivers (Android & iOS)
- Central server + apps by 3G
- Central server + open data (FIWARE)
- Complete route vs. step-by-step
- Pure gathering of information (GINF)
- Interactive maps + open data
- Profiles of drivers (clustering)
- Hardware search and installation
- Desktop application
- Know and describe present policies
- Simulate Málaga and other cities
- Weekly and peak hours analyses
- Use of available open data
- Tests with the traffic control center
- Comparisons with existing tools
- Interactive maps of TRL

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#RESOURCES

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Some projects: holistic Intelligence

 <http://eip.lcc.uma.es>

European Innovation Partnership 2014-2016

Malaga 

Visitors online
We have one guest and no members online.

Home

Presentation

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Active Action Clusters

- Business Models, Finance and Procurement
- Citizen Focus
- Integrated Infrastructure & Processes
- Policy & Regulations / Integrated Planning

This EIP is led by the Univ. of Málaga (UMA) in Spain, and its aim is at gathering together a world consortium endowed of all the basic elements to do quick research, development and innovation in SCC. We have a focus on EU organizations, namely research centers and universities, but also of those highly interested in advancing in this topic in relation to EU and H2020. We have also added other non-EU partners to create a world task force on R&D in SCC.

Our consortium is a specialized mix of:

- Researches on intelligent systems in ICT, with expertise in theory and practice in SCC
- Companies also of business final products.

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#RESOURCES

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Open data in the world

 <http://eip.lcc.uma.es/opendata/>

OPEN DATA IN THE WORLD 

With data catalogs about
3 continents - 63 countries - 67 regions - 174 cities

OPEN DATA WORLD MAP

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#RESOURCES

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Many new services...and apps!

NEO apps for Android

A floating car rides the city with a given plan, collecting information and events

Pedestrians can have the route of lower temperature to their destination

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#RESOURCES

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The place for smart cities in Europe

<https://eu-smartcities.eu>

Market Place of the European Innovation Partnership on Smart Cities and Communities

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- European Innovation Partnership on Smart Cities: Launch of the European...

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#RESOURCES

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Rankings on Smart cities

- <http://www.fastcoexist.com/3024721/the-10-smartest-cities-in-europe>
- <http://www.fastcoexist.com/3021592/the-10-smartest-cities-in-north-america>
- <http://www.fastcoexist.com/3021911/the-10-smartest-asia-pacific-cities>
- <http://www.fastcoexist.com/3022533/the-8-smallest-cities-in-latin-america>
- <http://eponline.com/articles/2015/02/18/the-top-5-global-smart-cities-of-2015.aspx>

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Summary

- Smart cities need **efficient** and **effective** modern problem solvers
- We can use existing **information and procedures** to improve them (a must!)
- We can build small/large, context-aware and adaptive **applications**
- Here, solutions are both **vertical** (specialized) and **horizontal** (integral)
- We must face **multiple levels** at smart cities: citizens, districts, city, routes, infrastructure, city council, public/private companies...
- We can exploit **open/big data** to build unseen new services
- Incorporating a **business model** is mandatory: so how to make **research?**
- An amazing domain for new **ideas and collaborations** !!!

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