Intelligent Systems for Smart Cities

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Smart cities: unique features

Welcome to TheSmarterCity

IBM

- Airports
- Energy & Utilities
- Public Safety
- Economic Development
- Rail
- Social Services
- Education
- Communications

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

HOLISTIC
TECHNOLOGY
INFORMATICS
TELECOMS
MULTIDISCIPL.
CITIZENS
MANAGERS
Many views: potential targets

**THINK BIG**

- Smart City Techniques
- Smart mobility
- Energy and water
- Urban Applications

**THINK SMALL**

- IBM Smart City
- Techniques
- Smart mobility
- Energy and water
- Urban Applications
Many views: applications and infrastructure

**Focus on Services**

**Focus on Architecture**

**Sensors and Cities**

**Smarter Operations:**
Sensors can measure, track and locate a wide variety of factors in the urban environment. Data from sensors can be analyzed and used to run systems more efficiently and effectively, improving services for citizens while reducing the cost of government operations.

**Big Business:**
By 2020, cities are expected to spend $20 billion on sensor technology.

**Sensor-based Applications Include:**
- Traffic congestion
- Transit
- Parking
- Environmental monitoring
- Waste collection
- Crime and public safety

**Cities with Sensor-based Solutions:**
- Montreal
- Rio de Janeiro, Brazil
- Santiago, Spain
- Singapore

**Economic Power:**
The 150 largest metro areas in the U.S. produce 75% of the national GDP.

**Population Centers:**
By 2050, six out of 10 people in the world will live in cities; the number will reach seven out of 10 by 2060.

** Shrinking Workforce:**
U.S. cities have cut more than 500,000 jobs from their payrolls. City revenue declined every year between 2008 and 2012.
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.
Many views: IT and intelligence

- Equipment management
- Operational information
- Analysis and simulation

Urban management infrastructure

IT

Energy and water

Smart City

Techniques

Smart mobility

Emerging Optimization

Networking and Emerging Optimization 2017

Many views: IT and intelligence

- Equipment management
- Operational information
- Analysis and simulation

Urban management infrastructure

IT

Energy and water

Smart City

Techniques

Smart mobility

Emerging Optimization

Networking and Emerging Optimization 2017
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
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, ...
Metaheuristic versus the rest of solvers

How they work

Exhaustive

Advanced

Metaheuristics

What this means

Others cannot...

MetaH CAN!

Classic Techniques

Metaheuristics

efficiency
Efficient, accurate, and even Nature-inspired!

Evolutionary Algorithms

Survival of the fittest

Bio-inspired Computing

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

Convex Combination
Metric Space

Global best
New position
Best known

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

(0,2; -1,4; 3,5) → Solution Vector
(1,0; 10,3; 7,2) → Standard Deviation
(1,7; 0,3; 2,1) → Search Angles

Present Solution
New Solution

Inspiration
- 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
Multidisciplinary experience is common here
Scientific success reported in journals...
Companies and city administrations are deeply involved

Municipalities, University & Industry
Applications (I)

Smart Mobility

roadME

http://roadME.lcc.uma.es

moveON

http://moveON.lcc.uma.es
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).
Smart semaphore control: technologies

- High dimension problem
- Considering the whole city details
- Maps, locations, driving rules, vehicles...
- Comprehensive simulations with real data
- Long processing times

Particle Swarm Optimization
Smart semaphore control: results

- Optimized semaphore schedules have **benefits** in terms of:
  - Traffic congestion control
  - Prevention of severe traffic jams
  - Reduction of CO$_2$ emissions and fuel consumption
  - Driver/pedestrian safety

- A tech/tech combination

- Successful scientific results
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
Smart Red Swarm: architecture

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
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)

Our goal is to reduce the travel time of the vehicles in high density conditions, and then pollution
Smart Red Swarm: some results on travel times

Red Swarm reduces travel and waiting times

It works in unseen scenarios
Smart Red Swarm: ecofriendly results

Paris

Travel Time | CO | CO2 | HC | PM | NO | Fuel
---|---|---|---|---|---|---
Experts' Solution | 8.9% | 11.6% | 3.8% | 5.1% | 3.9% | 3.8%
Red Swarm | 10.4% | | | | | |

Stockholm

Travel Time | CO | CO2 | HC | PM | NO | Fuel
---|---|---|---|---|---|---
Experts' Solution | 17.5% | 16.1% | 7.1% | 16.7% | 10.2% | 6.8%
Red Swarm | | | | | | |

Berlin

Travel Time | CO | CO2 | HC | PM | NO | Fuel
---|---|---|---|---|---|---
Experts' Solution | 13.9% | 13.2% | 4.8% | 14.5% | 7.9% | 4.6%
Red Swarm | 13.3% | | | | | |
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
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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Values</th>
<th>Range</th>
</tr>
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<tbody>
<tr>
<td>ACTIVE_ROUTE_TIMEOUT</td>
<td>3.0 s</td>
<td>1.0 ... 10.0</td>
</tr>
<tr>
<td>ALLOWED_HELLO_LOSS</td>
<td>2 HELLO packets</td>
<td>1 ... 10</td>
</tr>
<tr>
<td>MY_ROUTE_TIMEOUT</td>
<td>2.0 × ACTIVE_ROUTE_TIMEOUT</td>
<td>1.0 ... 10.0</td>
</tr>
<tr>
<td>NET_DIAMETER</td>
<td>35 nodes</td>
<td>1 ... 50</td>
</tr>
<tr>
<td>NODE_TRAVERSAL_TIME</td>
<td>0.04 s</td>
<td>0.01 ... 1.0</td>
</tr>
<tr>
<td>NET_TRAVERSAL_TIME</td>
<td>2.0 × NODE_TRAVERSAL_TIME × NET_DIAMETER</td>
<td>1.0 ... 10.0</td>
</tr>
<tr>
<td>RREQ_RETRIES</td>
<td>2 tries</td>
<td>1 ... 10</td>
</tr>
<tr>
<td>RREQ_RATELIMIT</td>
<td>10.0 kbps</td>
<td>1.0 ... 10.0</td>
</tr>
<tr>
<td>TTL_START</td>
<td>1.0 s</td>
<td>1.0 ... 10.0</td>
</tr>
<tr>
<td>TTL_INCREMENT</td>
<td>2.0 s</td>
<td>1.0 ... 10.0</td>
</tr>
<tr>
<td>TTL_THRESHOLD</td>
<td>7.0 s</td>
<td>1.0 ... 20.0</td>
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</table>

**AODV**

**RFC 3561**
Optimization by using simulators fed with real data

Optimization Algorithms

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

Solution Evaluation

Protocol configuration
\[ X_0 \ x_1 \ x_2 \ x_3 \ x_4 \ \ldots \]

Ns-2 VANET simulation

VANET communication protocols

Fitness evaluation

Communication metrics
\[ f_0 \ f_1 \ f_2 \ f_3 \ \ldots \]

Real world VANET scenarios

Optimize and then deploy (iterated)
Broadcasting optimization: QoS in VANETs

\[ \text{fitness} = w_1 \cdot (-PDR) + w_2 \cdot NRL + w_3 \cdot AEED \cdot C \]

- Packet Delivery Ratio
- Network Routing Load
- Average End-to-End Delay

Median Performance - Urban Scenario

<table>
<thead>
<tr>
<th>Method</th>
<th>PSO</th>
<th>DE</th>
<th>SA</th>
<th>GA</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Cost</td>
<td>2.9</td>
<td>2.6</td>
<td>2.4</td>
<td>2.8</td>
<td>2.9</td>
</tr>
<tr>
<td>Number of Evaluations</td>
<td>0</td>
<td>200</td>
<td>400</td>
<td>600</td>
<td>800</td>
</tr>
</tbody>
</table>

Effective Data Rate (kBytes/s)

- PSO: 300.29
- DE: 292.57
- SA: 285.23
- GA: 283.65
- Human Experts: 242.65
- Best: 241.5
Green communications: optimizing energy

**fitness = energy_consumption**

![Energy Consumed Grouped by Urban Scenarios](chart.png)

- **DE-OLSR**
- **OLSR**
- **DE-OLSR**
- **OLSR**
- **DE-OLSR**
- **OLSR**

Scenario U1 | Scenario U2 | Scenario U3
--- | --- | ---
Routing | CBR/MACPHY

![Vehicle and Environmental Icons](icons.png)
Real world tests

- From simulation to real world results:

- The real world test results confirm the (ns-3) simulated ones
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**
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
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.

---

<table>
<thead>
<tr>
<th>ORIGEN</th>
<th>HORARIO</th>
</tr>
</thead>
</table>
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.
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
Smart surface parking (I)

- 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):
  - Reducing the prices in the areas with more free parking places.

- Allows mobile payment.
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 CO$_2$ emissions and noise pollution
Smart signs

- "Policemen near to you, ask for help"

- Everything is better with WiFi!
Applications (II)

Energy, buildings and much more
Smart energy systems

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

**Wind Farm Design**  
**Disaggregation and Savings**
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
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.
This smart garden watering system improves gardening activities in the city by minimizing the waste of water.
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.
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.
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.

![Map of Traditional and Optimal Routes]

**Traditional Route:** 5.3km  
**Optimal Route:** 2km
Smart building construction: the approach

- Safer, sustainable, modern design principles
- Complex simulations needed
- Optimization and machine learning needed
Smart building construction: techniques and technologies

<table>
<thead>
<tr>
<th>CASE</th>
<th>NO SHADOWS</th>
<th>43,290</th>
<th>62,920</th>
<th>106,210</th>
<th>57,006</th>
<th>41,282</th>
<th>98,288</th>
<th>75.94%</th>
<th>152.42%</th>
<th>100.00%</th>
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<tbody>
<tr>
<td>CASE 2</td>
<td>NO LOGS JUST PROJECTING</td>
<td>46,129</td>
<td>51,458</td>
<td>97,587</td>
<td>57,006</td>
<td>41,282</td>
<td>98,288</td>
<td>80.92%</td>
<td>124.65%</td>
<td>100.00%</td>
</tr>
<tr>
<td>CASE 3</td>
<td>25% LOGS SHADOW RATE</td>
<td>49,110</td>
<td>39,164</td>
<td>88,274</td>
<td>57,006</td>
<td>41,282</td>
<td>98,288</td>
<td>86.15%</td>
<td>94.57%</td>
<td>100.00%</td>
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<tr>
<td>CASE 4</td>
<td>40% LOGS SHADOW RATE</td>
<td>52,634</td>
<td>29,917</td>
<td>82,551</td>
<td>57,006</td>
<td>41,282</td>
<td>98,288</td>
<td>92.31%</td>
<td>72.47%</td>
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<td>CASE 5</td>
<td>50% LOGS SHADOW RATE</td>
<td>57,493</td>
<td>26,406</td>
<td>83,899</td>
<td>57,006</td>
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<td>98,288</td>
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<td>63.97%</td>
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<td>75% LOGS SHADOW RATE</td>
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<td>22,896</td>
<td>85,248</td>
<td>57,006</td>
<td>41,282</td>
<td>98,288</td>
<td>105.88%</td>
<td>55.46%</td>
<td>100.00%</td>
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<tr>
<td>CASE 7</td>
<td>100% LOGS SHADOW RATE</td>
<td>67,211</td>
<td>19,385</td>
<td>86,596</td>
<td>57,006</td>
<td>41,282</td>
<td>98,288</td>
<td>117.90%</td>
<td>46.96%</td>
<td>100.00%</td>
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</table>

% PROJECT VS REFERENCE BUILDING

ENERGY DEMAND ANALYSIS (kWh/sqm)

<table>
<thead>
<tr>
<th>CASE</th>
<th>HEATING</th>
<th>COOLING</th>
<th>TOTAL</th>
<th>HEATING</th>
<th>COOLING</th>
<th>TOTAL</th>
<th>%</th>
<th>LIMIT</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>100.00%</td>
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<tr>
<td>CASE 2</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>100%</td>
<td>100.00%</td>
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<td>CASE 3</td>
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<td></td>
<td></td>
<td>100%</td>
<td>100.00%</td>
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<td>CASE 4</td>
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<td></td>
<td></td>
<td>100%</td>
<td>100.00%</td>
</tr>
<tr>
<td>CASE 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

ENERGY DEMAND kWh/sqm-year

CASE 1
CASE 2
CASE 3
CASE 4
CASE 5
CASE 6
CASE 7

The NEO Team
Smart Cities

2017 Networking and Emerging Optimization

Urban Applications
Smart City Techniques
Smart mobility
Energy and water

48 of 65
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.
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
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:
  - touristic places, events, welcome messages, administrative procedures, voice info-links, recommendations, activities, video-streaming, etc.
Smart QRinfo (II)

- With Smart QRInfo it is possible to redirect participants’ 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.
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
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...
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...
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
Some projects: vehicular communication networks

New techniques: from theory to practice

At a glance

Real life testing

http://roadme.lcc.uma.es
Some projects: intelligent applications

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

http://maxct.lcc.uma.es
Some projects: holistic Intelligence

European Innovation Partnership 2014-2016

http://eip.lcc.uma.es

Visitors online
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Presentation

This EIP is led by the Univ of Malaga (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, companies and cities, all of them 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:
- Researchers on intelligent systems in ICT, with expertise in theory and practice in SCC.
- Companies able of building final products.
Open data in the world

http://eip.lcc.uma.es/opendata/
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.
The place for smart cities in Europe

https://eu-smartcities.eu

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

Towards a Market Place for Smart Cities

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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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Málaga (España)

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