

IoT in cultural heritage: the path from monitoring to preventive conservation



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POLITÈCNICA
DE VALÈNCIA

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Chişinău

December 16-17, 2020

Contents



- About us
- What we do
- Our experiences in cultural heritage
- Other experiences
 - Alcoi smartcity - empowering citizens project
 - Smart tourism - Sustainable tourism
- European funding possibilities



About us

Public University

Students	38,000
Schools and Faculties	13
Faculty and research personnel	2,660
Departments	42
Personnel of admin./services:	1,586
Undergraduate degrees	35
Official Master degrees	59
PhD programs	30
R+D+i financial volume	100,7 M€

Schools and faculties

School of Agricultural Engineering and Environment
School of Applied Computing Science
School of Engineering Design
School of Architecture
School of Building Management
School of Civil Engineering
School of Computer Engineering
School of Geodesy, Cartography & Surveying
School of Industrial Engineering
School of Telecommunications Engineering
Faculty of Business Administration & Management
Faculty of Fine Arts



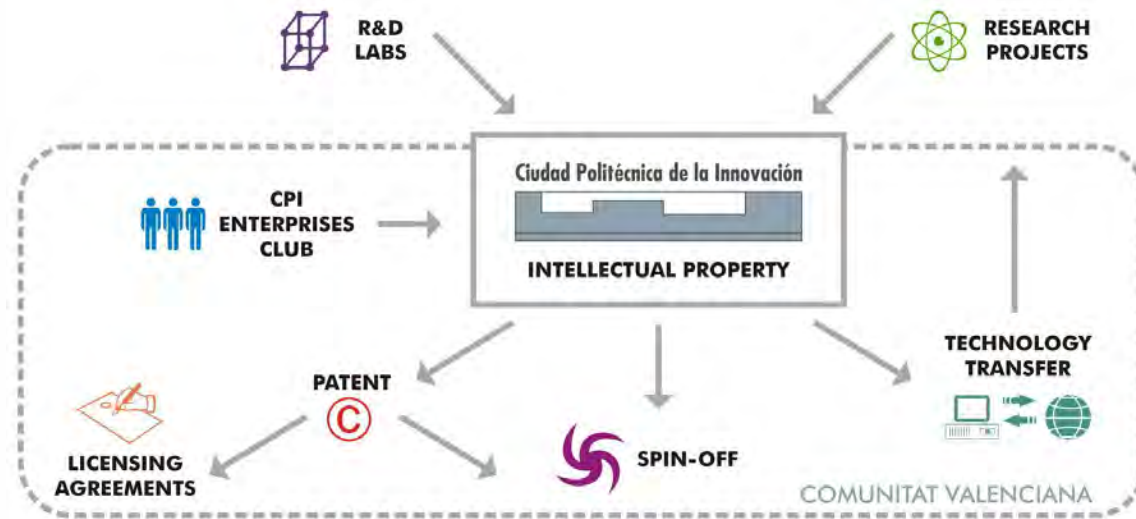
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<http://www.upv.es>



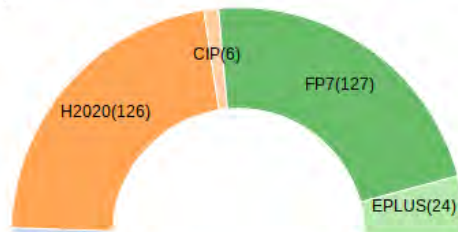
About us

Institutes and research centres



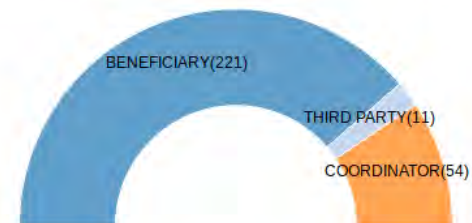
Programmes

- RFCS(1)
- CREA(2)
- H2020(126)
- CIP(6)
- FP7(127)
- EPLUS(24)



Roles

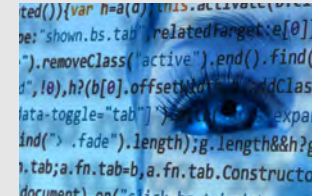
- BENEFICIARY(221)
- THIRD PARTY(11)
- COORDINATOR(54)



About us

ITACA Institute Information and Communication Technologies

Research areas



01 Computer Science



02 Telecommunications



03 Production Technologies
and Materials



04 Energy, Transport and
Environment



05 Health and Wellbeing



WORK LINES

- Modeling and simulation of digital systems, especially wireless sensor networks and actuators
- Design of embedded systems based on microcontrollers and general-purpose processor (embedded Linux)
- Design of ultra-low power wireless sensor/actuator nodes
- Low-power wide area networks (LP-WAN)

APPLIED TO

- Industrial informatics: automotive, energy generation & distribution, industrial condition monitoring, etc.
- Sensing: fish farms, livestock farms, preventive conservation, precisión agricultura (wine, oranges), tourism, smartcity
- Asset tracking (food, industrial assets)



Diesel engine control system (ECU)



Rail-way critical system monitoring



CO2 wireless monitoring of farms



Wireless termite detection system



Ultra-low power underwater modem

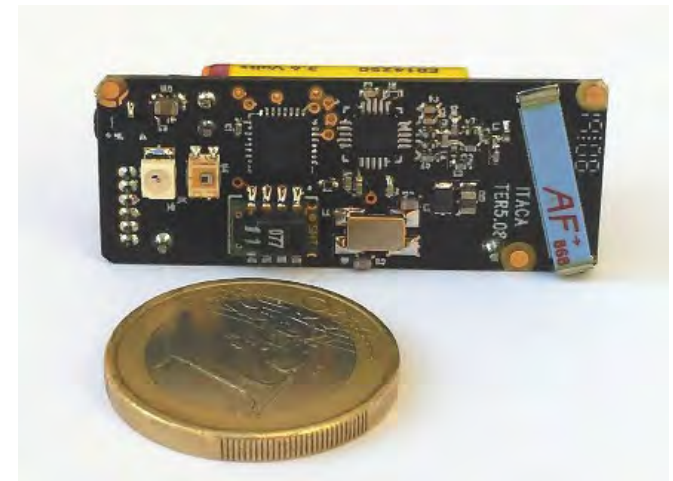
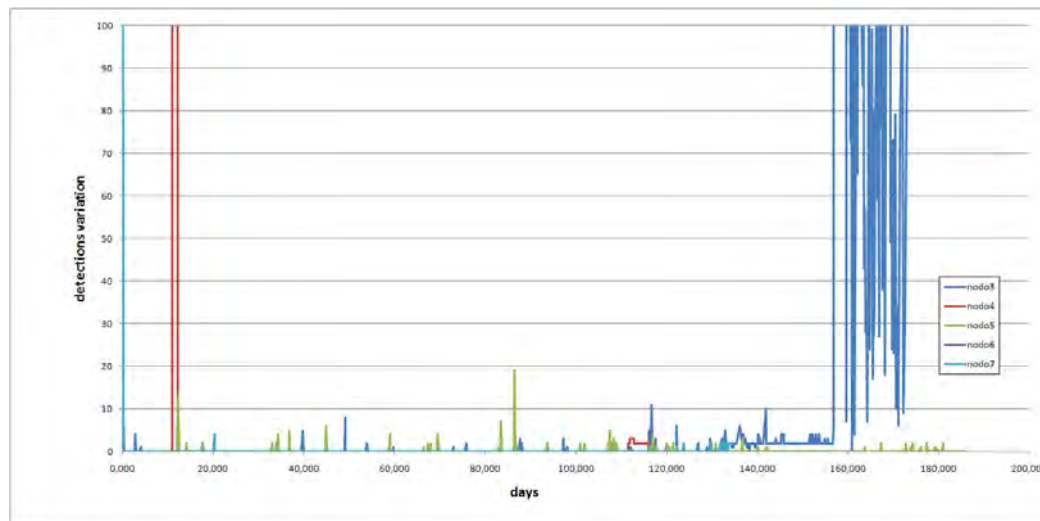
What we do

Application examples

Wood monitoring & termite detection Sensor
Company contract

Wireless node for xylophagous (termite) detection

- Embedded in wood to measure EMC and detect termites
- 13 year battery autonomy
- ISM 868 MHz wireless band
- Schweighofer Prize 2009
- Patented



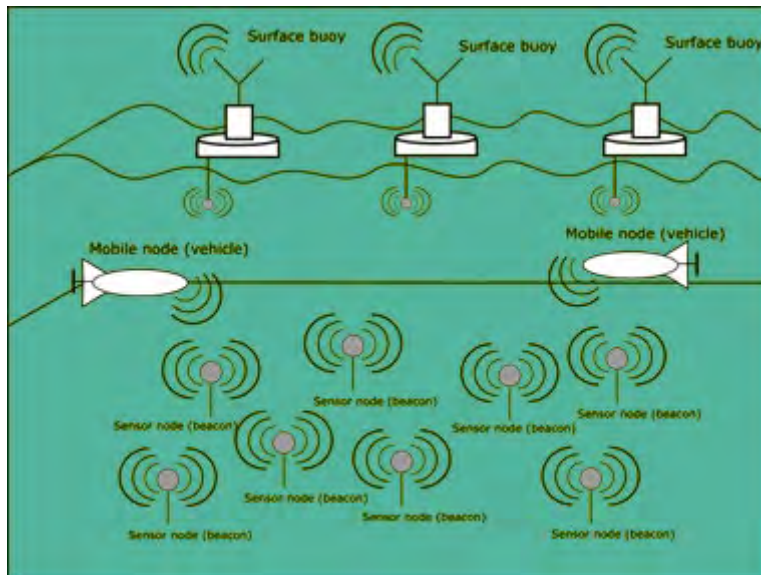
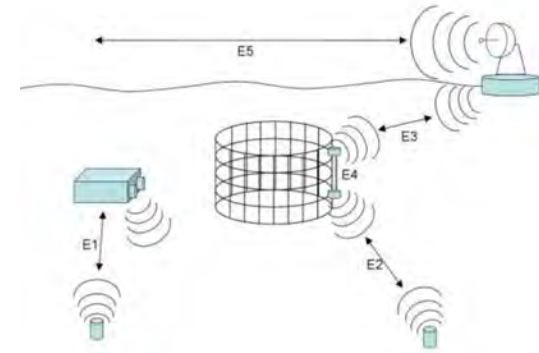
What we do

Application examples

Monitoring the Subaquatic Environment
Funded by the Spanish government

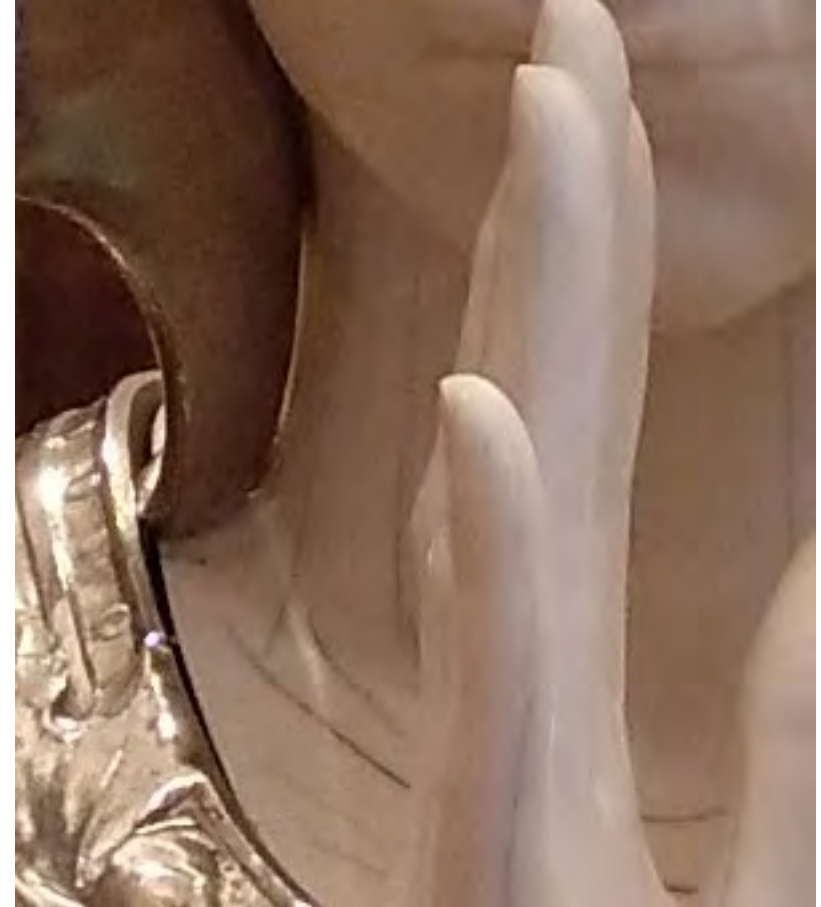
Underwater acoustic modem

- 1 Kbps, FSK modulation over 85 kHz
- *Acoustic Wake-up* only with 10 uA of consumption
- Maintenance-free for decades
- Applications in fish farming, seabed monitoring, guidance of *gliders*



Our experiences in cultural heritage

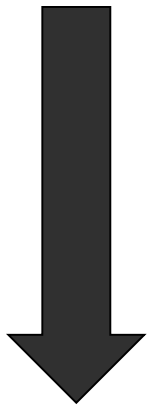
The problem of conservation



'Mysterious Sphinx' by Charles Van der Stappen. Museum of Art and History Brussels <http://www.kmkg-mrah.be/mysterious-sphinx>
A good read "How to keep for a while what you want to keep for ever" by Tim Padfield <http://www.padfield.org/tim/cfys>

Preventive conservation & IT

If the artefact has been in good condition for a long time, then maintaining this condition should be the best approach



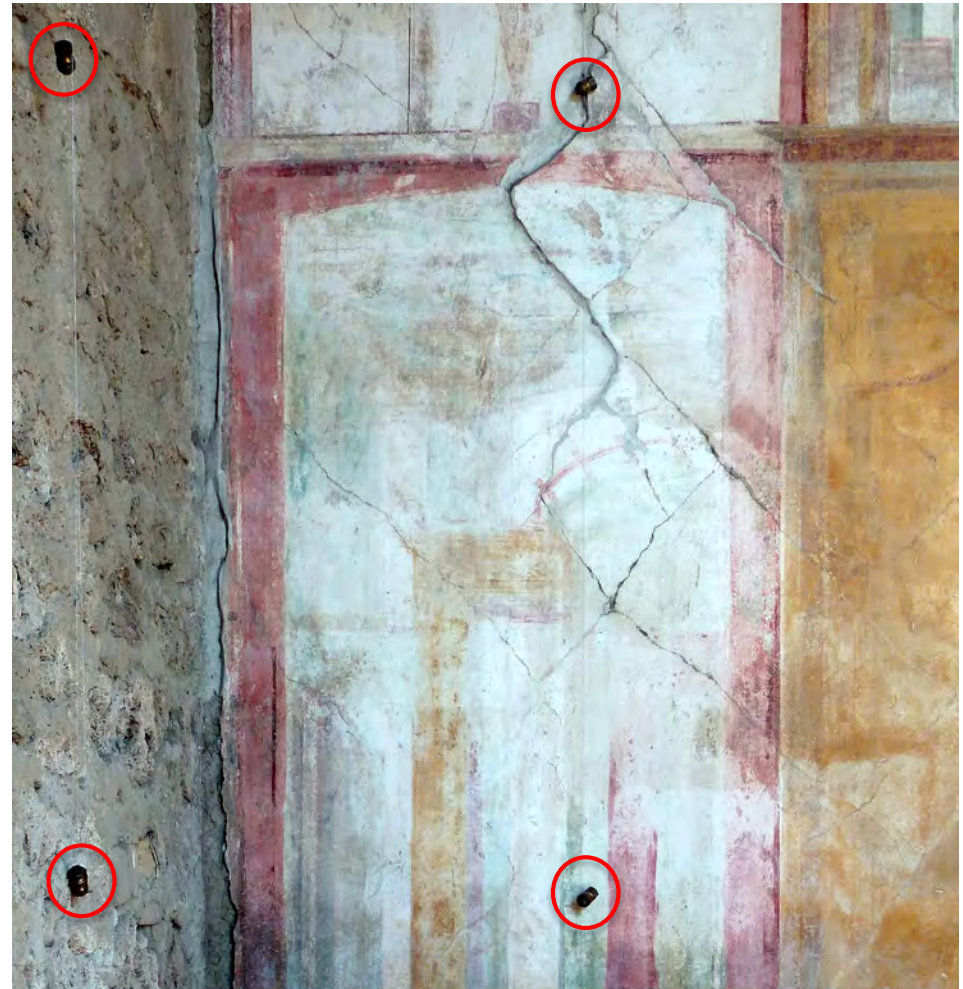
**Measure &
analyze**



1: datalogger approach

Sensing Casa Adriana – Pompei
Funded by the Spanish goverment

- Main problem:
 - Manipulation needed



Dataloggers in Casa Adriana,
Pompei (Italy)

2: wired sensors approach

Preventive Conservation of Valencia Cultural Heritage
Funded by the Spanish government

- Main problema:
 - Wiring is complex



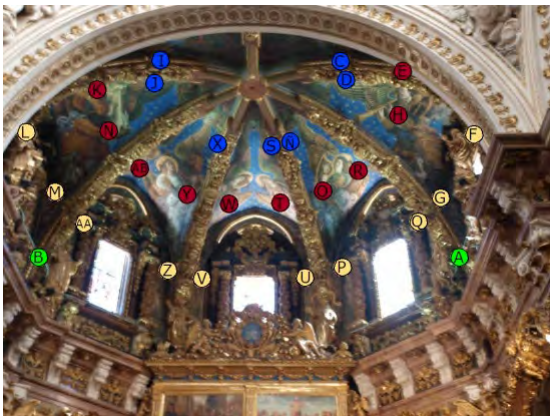
Wired sensors in the Cathedral
of Valencia (Spain)



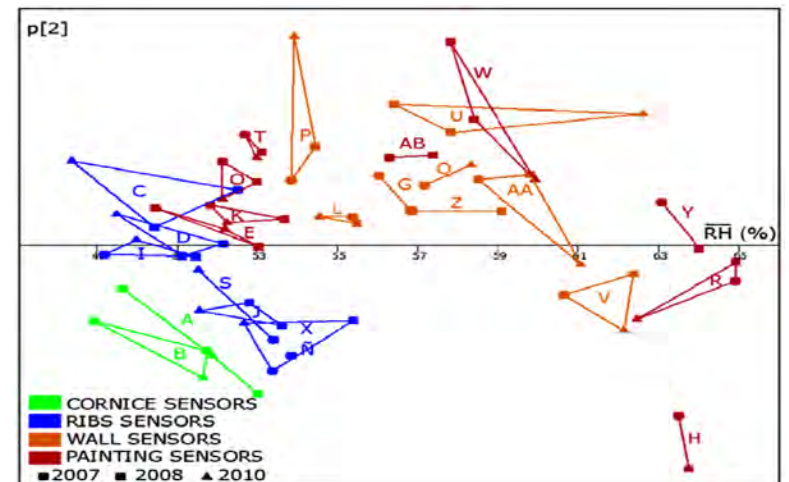
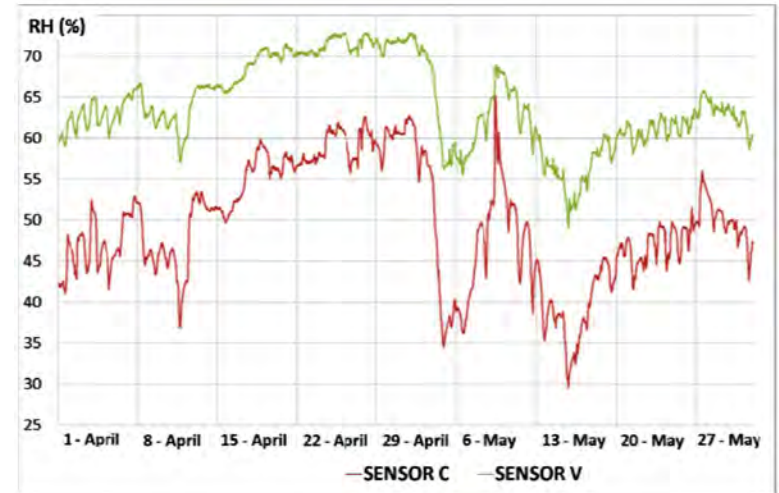
2: wired sensors approach

Preventive Conservation of Valencia Cultural Heritage
Funded by the Spanish government

- Main problem:
 - Wiring is complex



Wired sensors in the Cathedral of Valencia (Spain)



3: wireless sensor nodes

IoT to Preventive Conservation of Valencia Cultural Heritage
Funded by the Valencian government

- Main problem:
 - Basic IoT principle



Wireless sensors in Santo Tomás church, Valencia (Spain)

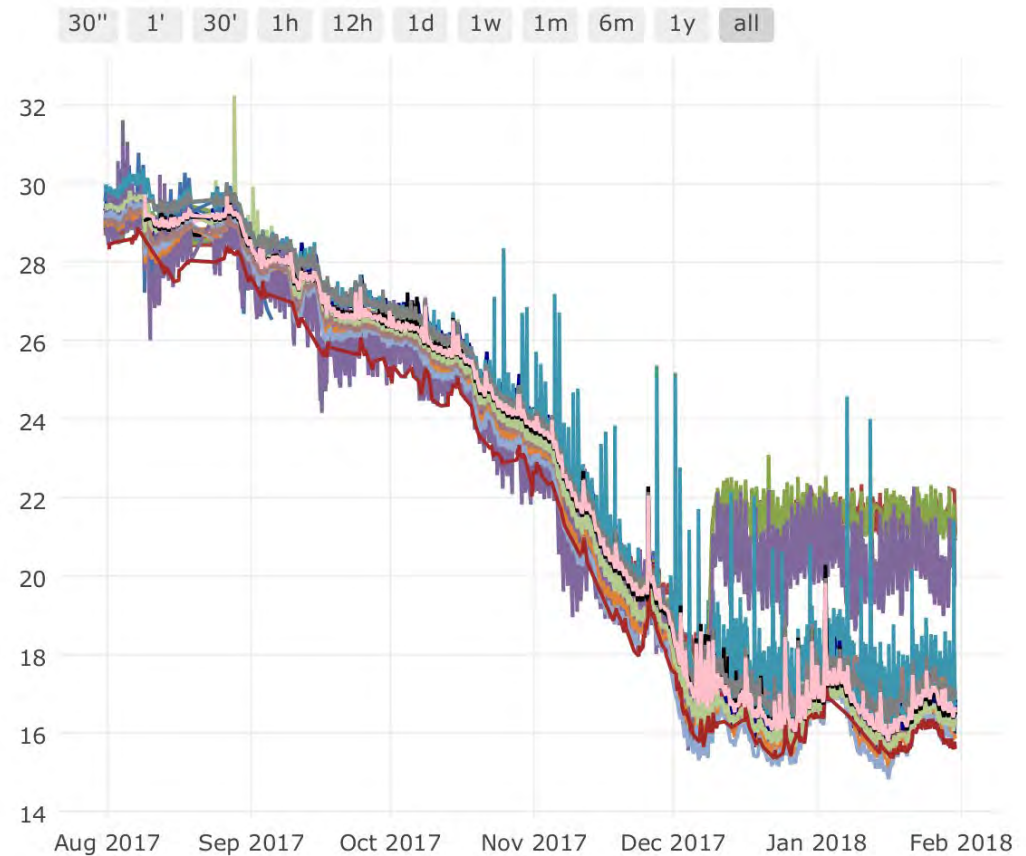


3: wireless sensor nodes

IoT to Preventive Conservation of Valencia Cultural Heritage
Funded by the Valencian government

- Main problem:
 - Basic IoT principle

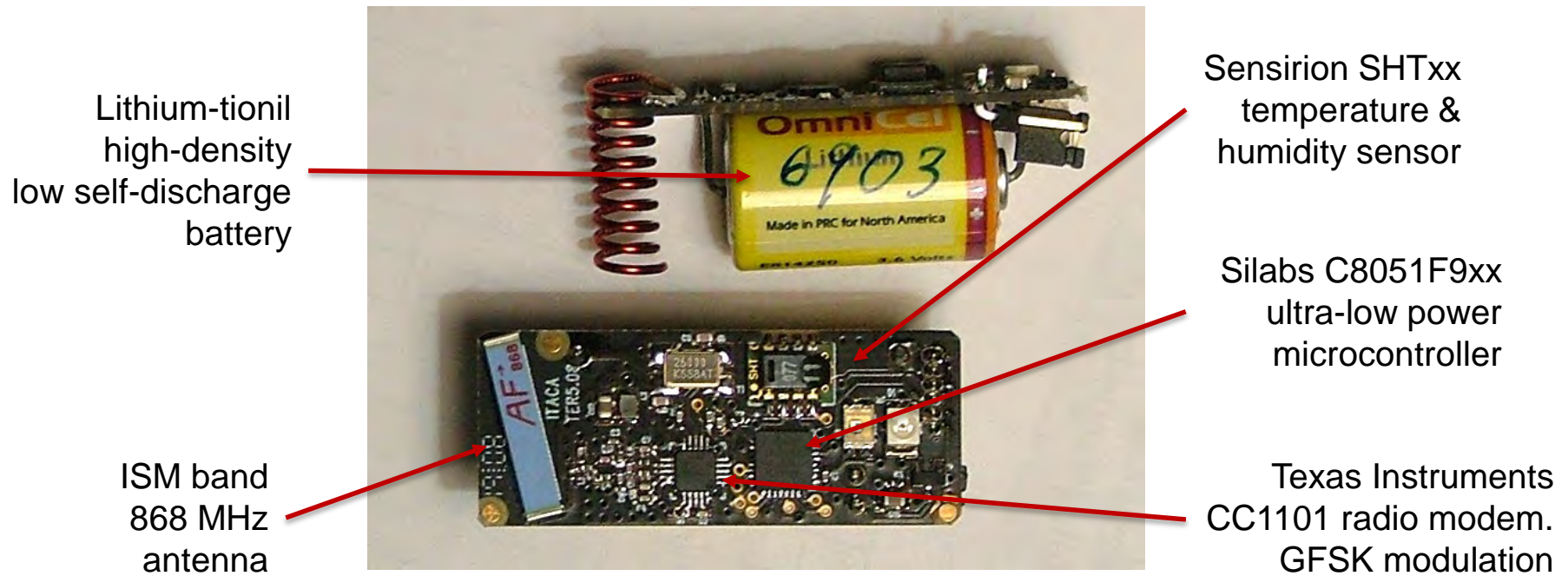
Seleccione un nodo: ▾



3: wireless sensor nodes

IoT to Preventive Conservation of Valencia Cultural Heritage
Funded by the Valencian government

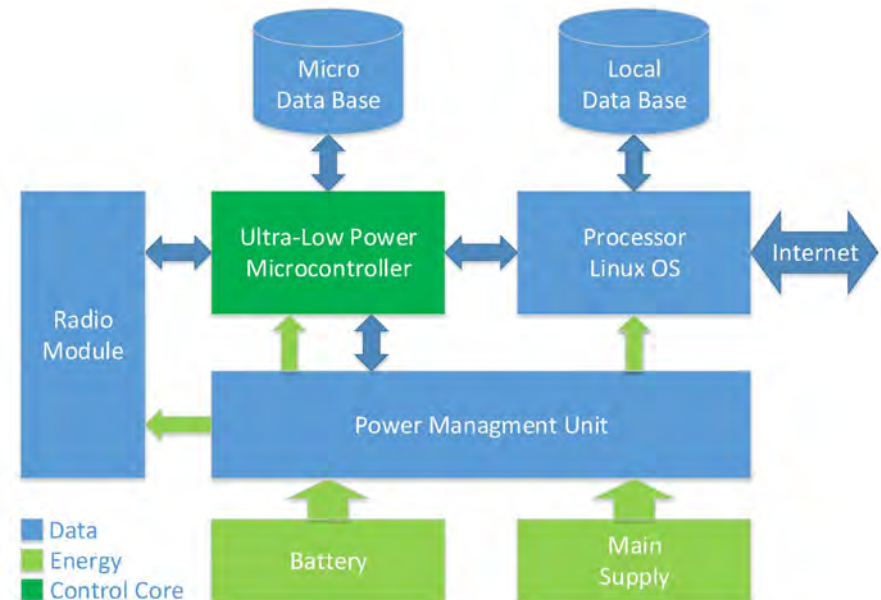
- Main problem:
 - Basic IoT principle



3: wireless sensor nodes

IoT to Preventive Conservation of Valencia Cultural Heritage
Funded by the Valencian government

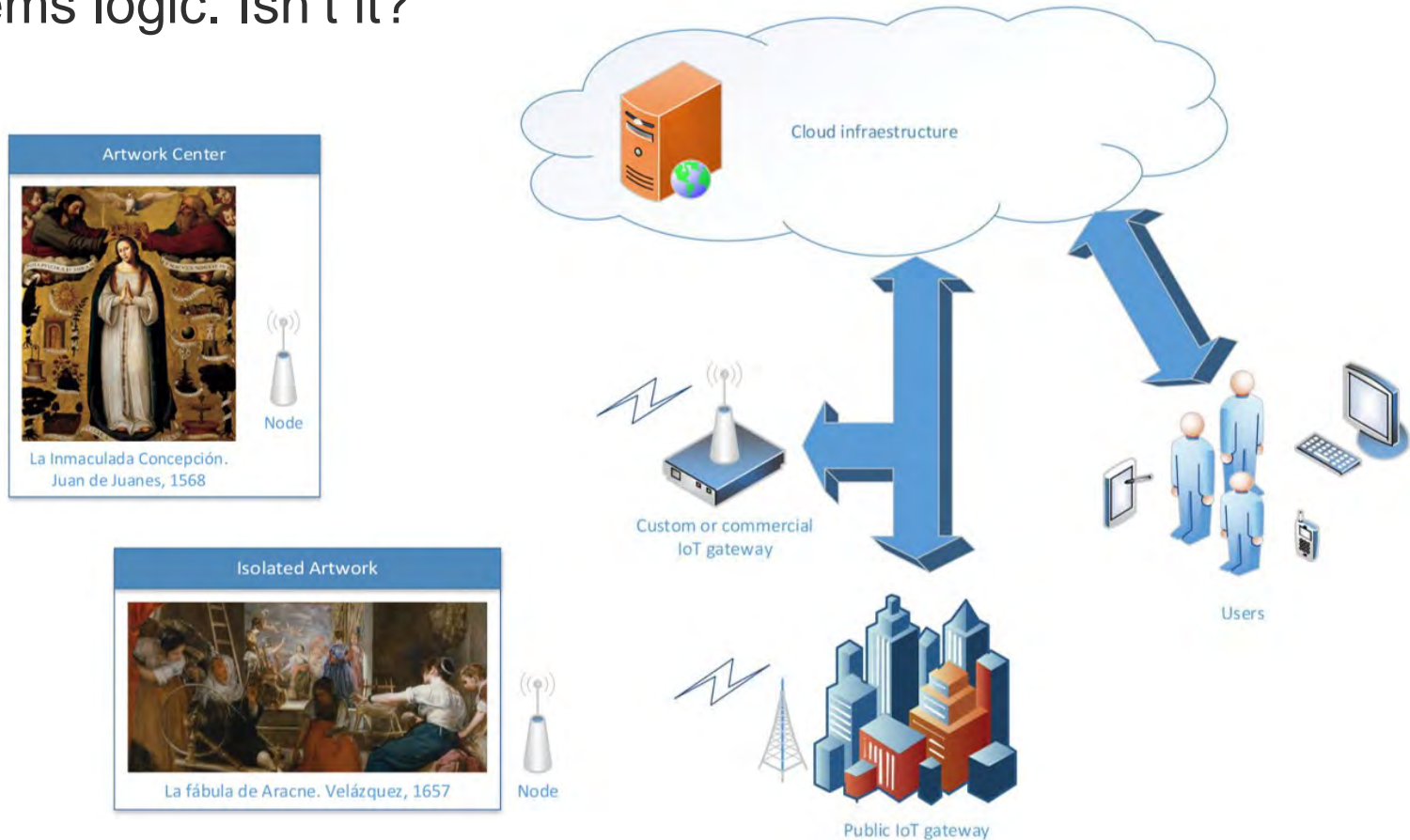
- Basic IoT principle



Our experiences in cultural heritage

4: full IoT approach

- Seems logic. Isn't it?



Our experiences in cultural heritage

4: full IoT approach

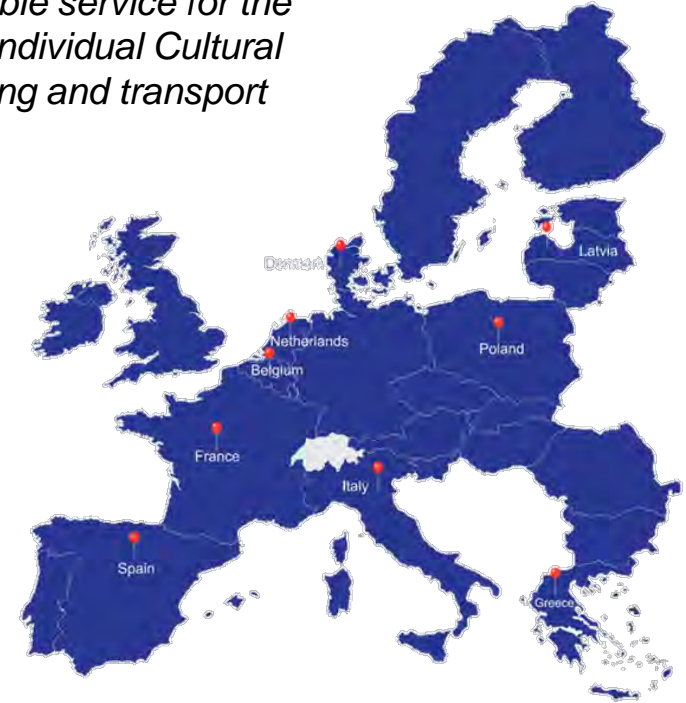


CollectionCare. Innovative and affordable service for the Preventive Conservation monitoring of individual Cultural Artefacts during display, storage, handling and transport



<https://collectioncare.eu>

- EU H2020 Project
- Grant Agreement N° 814624
- 6 M€ funding
- 18 partners
- Led by UPV



The Royal Danish Academy of Fine Arts,
Schools of Architecture, Design and Conservation
School of Conservation



Arabako Foru
Aidundia
Diputación
Foral de Álava



Kongernes Samling



Our experiences in cultural heritage

4: full IoT approach



Our experiences in cultural heritage

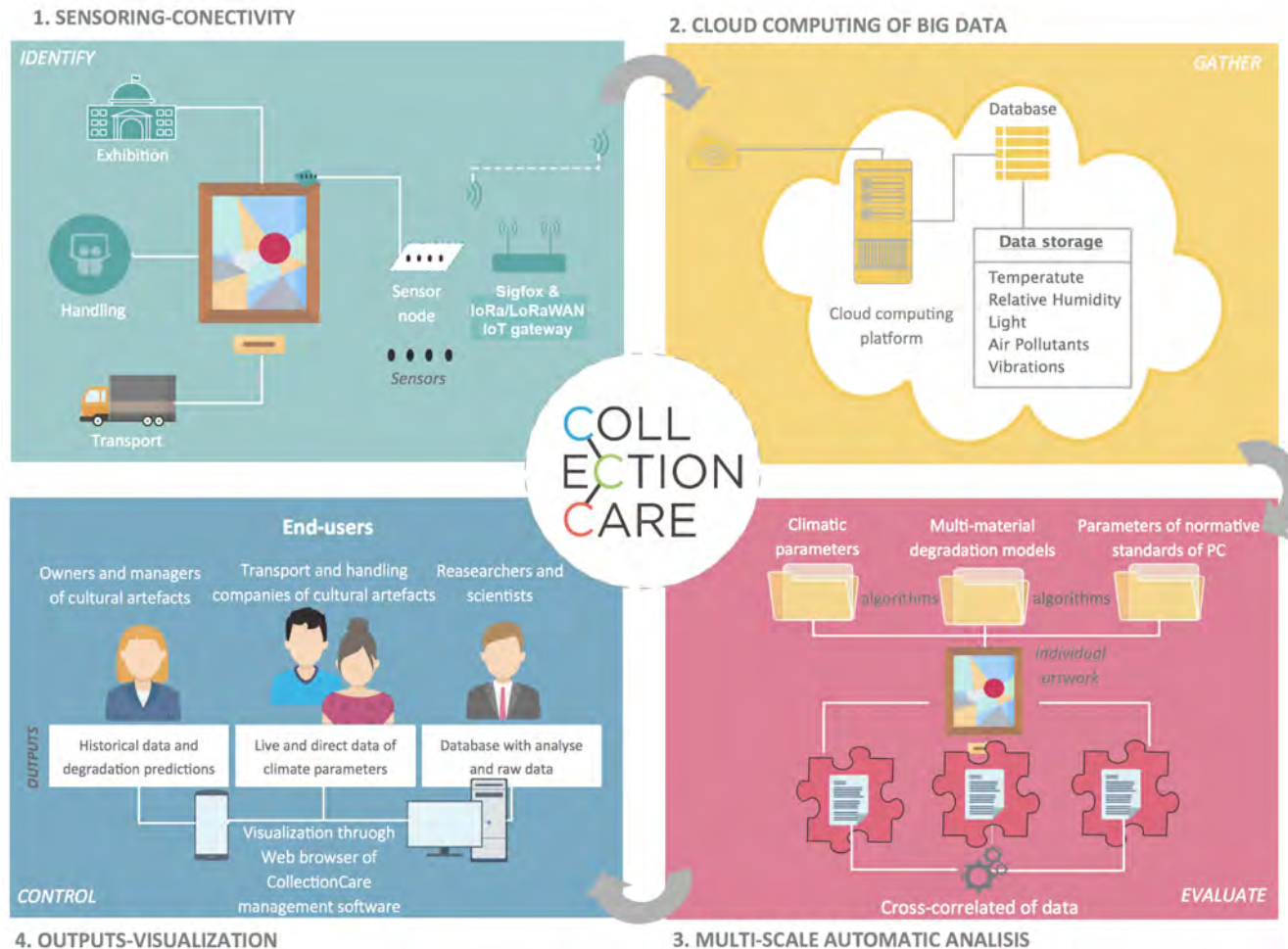
4: full IoT approach

Video presenting the project
[youtube.com/watch?v=LznqRnaX4OY](https://www.youtube.com/watch?v=LznqRnaX4OY)



Our experiences in cultural heritage

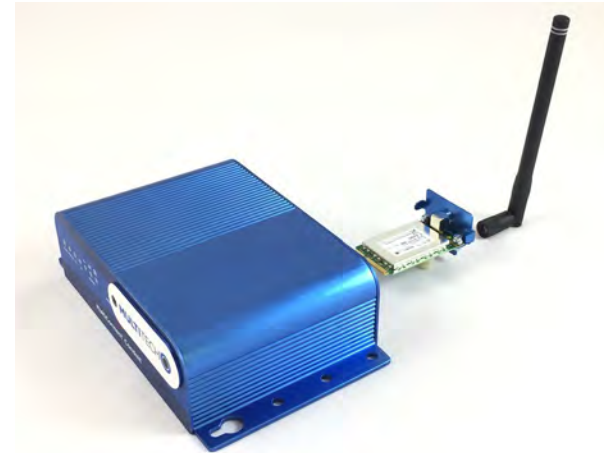
4: full IoT approach



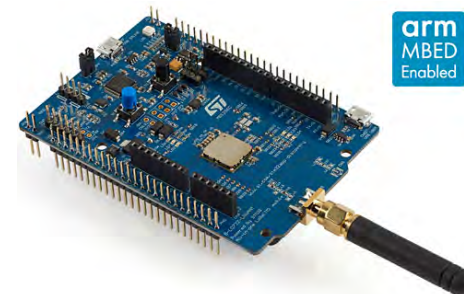
Our experiences in cultural heritage

4: full IoT approach

- Go standard “de facto” for wireless
- LPWAN
- Sigfox + LoRaWAN



E.g. Multitech LoRaWAN gateway



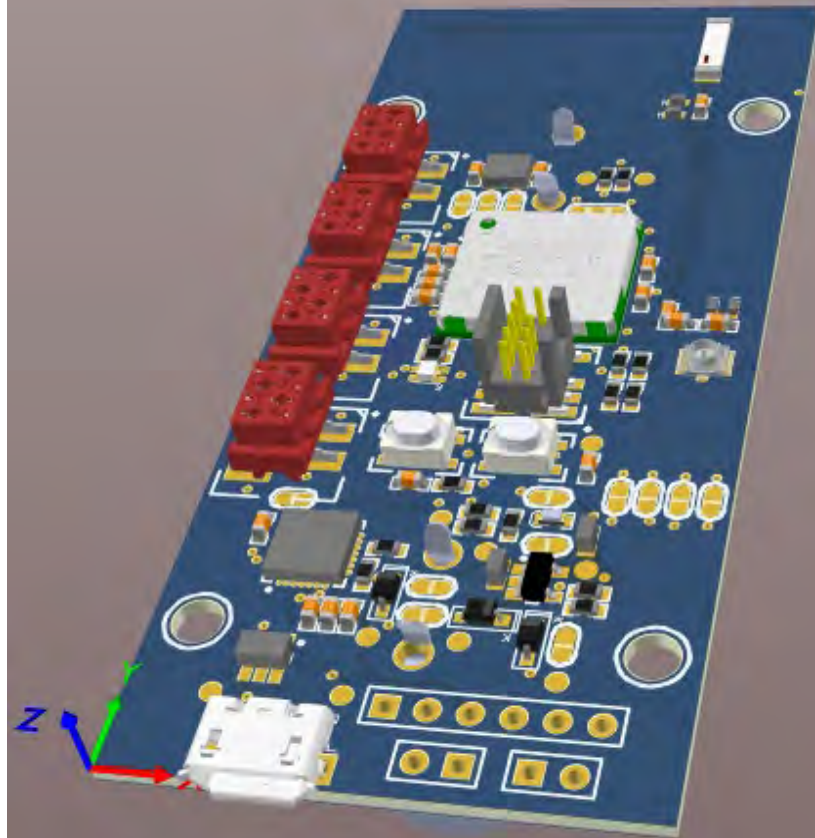
E.g. St's LoRaWAN starter kit
both Sigfox & LoRaWAN compatibility

4: full IoT approach

- Go standard (“de facto” for wireless)
- LPWAN
- Sigfox + LoRaWAN



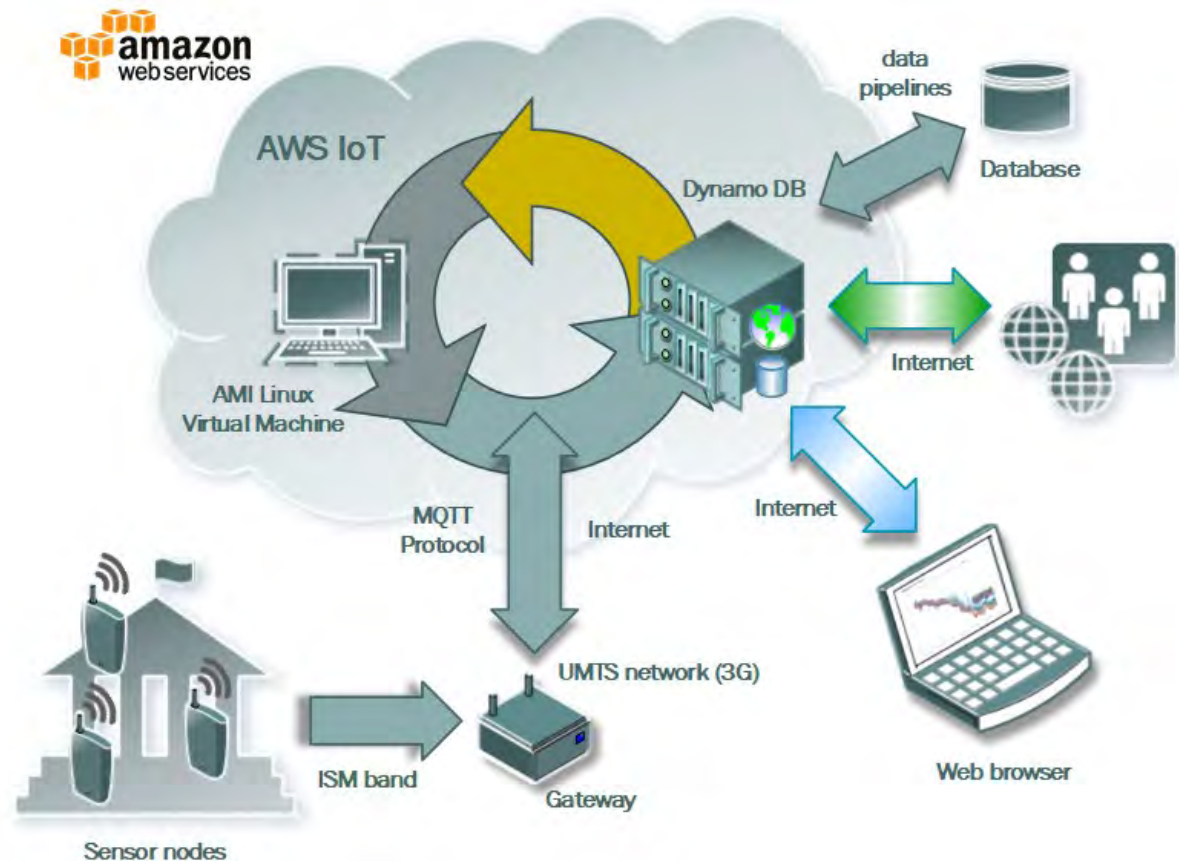
ITACA latest version of the wireless node



Our experiences in cultural heritage

4: full IoT approach

- Cloud implementation



Our experiences in cultural heritage

4: full IoT approach

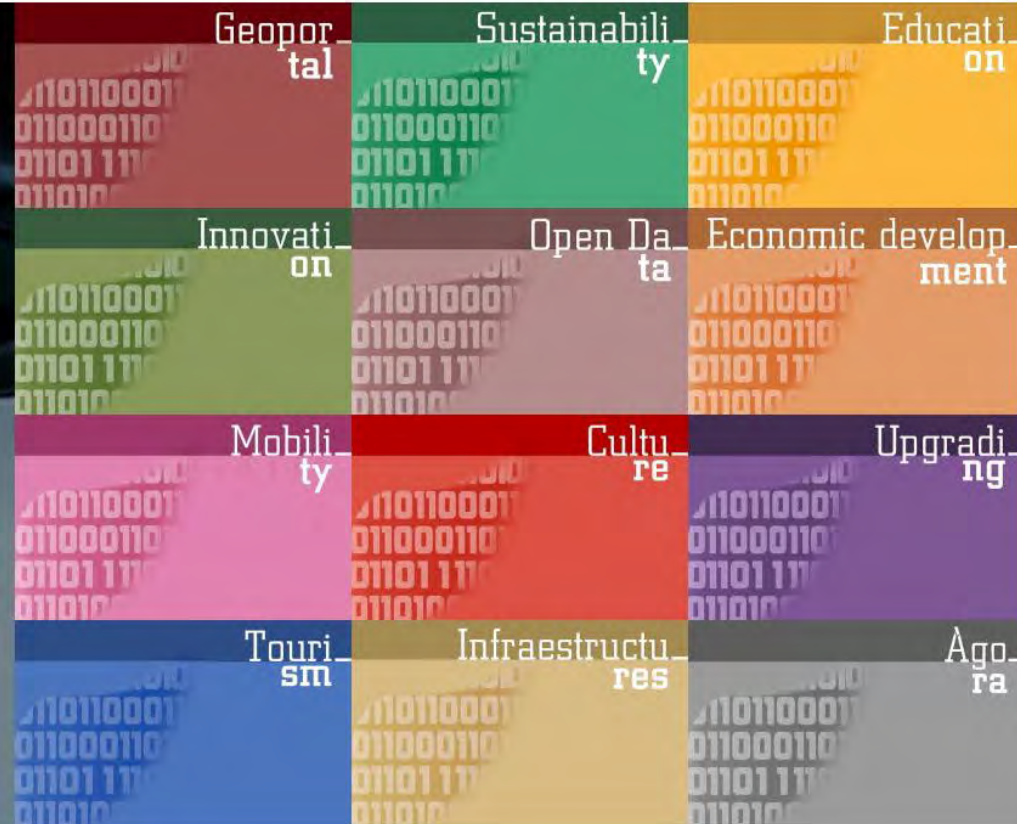
- Test in Rosenberg castle
- Both Sigfox & LoRaWAN



Other experiences

Empowering citizens

The city is not still, it shares the citizens' thrust.



<https://smartcity-alcoi.com/>



Other experiences

Empowering citizens



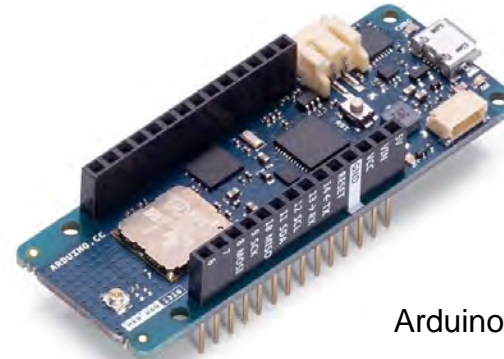
<https://smarcity-alcoi.com/>



Other experiences

Empowering citizens

- City council + UA + UPV
- LoRaWAN based
- The council provides connectivity
- Citizens can use this service



Arduino MKR WAN 1310



LoPy4



**THE THINGS
NETWORK**



BBC's Microbit

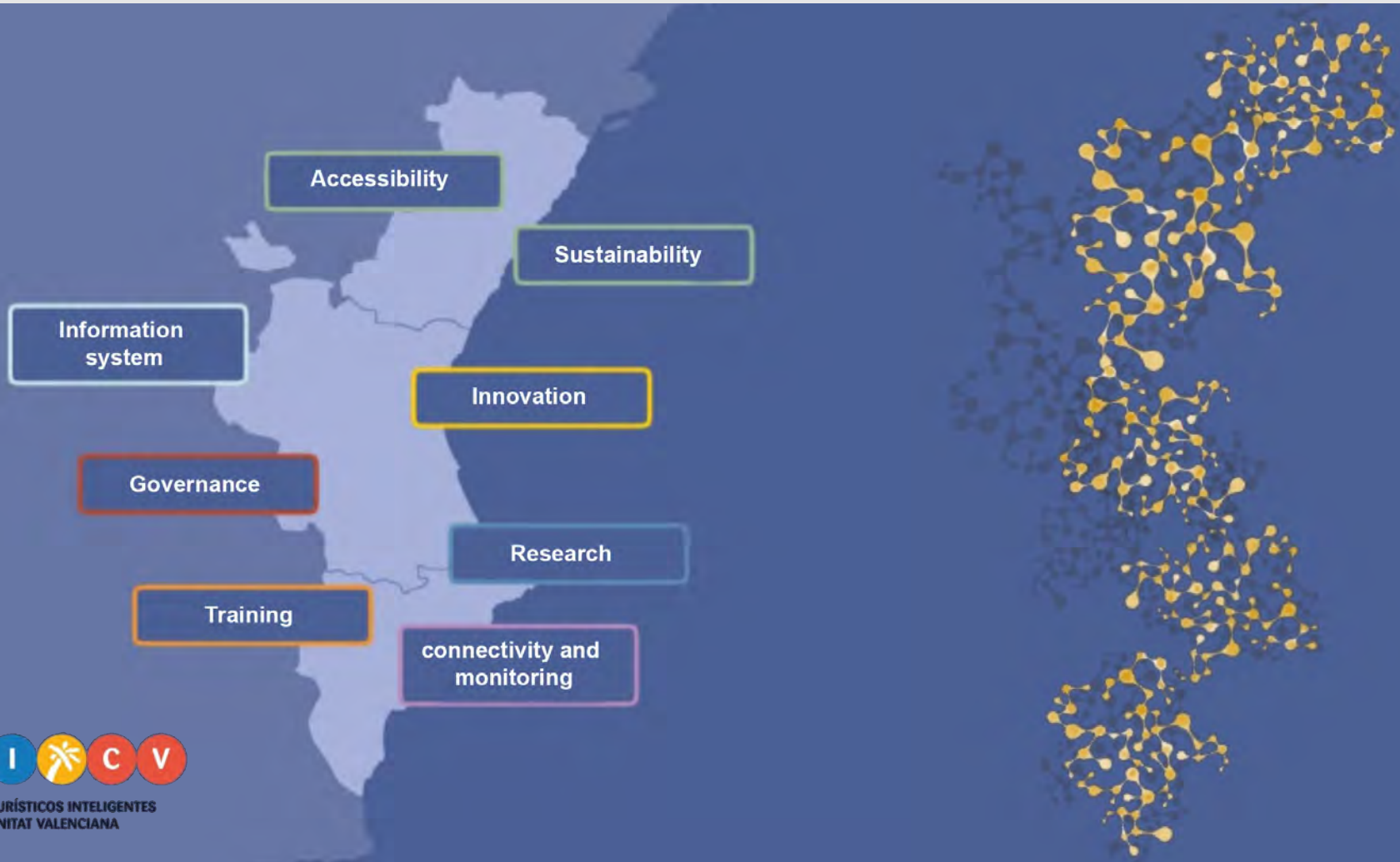
<https://smartcity-alcoi.com/>



Other experiences

Smart tourism - Sustainable tourism

Network of smart tourist destinations



DESTINOS TURÍSTICOS INTELIGENTES
COMUNITAT VALENCIANA



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Other experiences

Smart tourism - Sustainable tourism

Network of smart tourist destinations



RED DE DESTINOS TURÍSTICOS INTELIGENTES
COMUNITAT VALENCIANA



European funding possibilities

European Neighbourhood Policy



The screenshot shows the European Commission website page for Moldova. At the top, there is a navigation bar with the European Commission logo and the title "European Neighbourhood Policy And Enlargement Negotiations". Below this is a breadcrumb trail: "European Commission > Neighbourhood - Enlargement > Countries of the region > Moldova".

On the left side, there is a navigation menu with the following items:

- Home
- EU Neighbourhood Policy
- Overview
- Countries of the region
 - Algeria
 - Armenia
 - Azerbaijan
 - Belarus
 - Egypt
 - Georgia
 - Israel
 - Jordan
 - Lebanon
 - Libya
 - Moldova**
 - Morocco
 - Palestine*
 - Syria

https://ec.europa.eu/neighbourhood-enlargement/neighbourhood/countries/moldova_en



A BUDGET ALIGNED TO POLITICAL PRIORITIES Simplification, transparency and flexibility

In billion euro, current prices

I. SINGLE MARKET, INNOVATION AND DIGITAL €187.4

- 1 Research and Innovation
- 2 European Strategic Investments
- 3 Single Market
- 4 Space

II. COHESION AND VALUES €442.4

- 5 Regional Development and Cohesion
- 6 Economic and Monetary Union
- 7 Investing in People, Social Cohesion and Values

III. NATURAL RESOURCES AND ENVIRONMENT €378.9

- 8 Agriculture and Maritime Policy
- 9 Environment and Climate Action

IV. MIGRATION AND BORDER MANAGEMENT €34.9

- 10 Migration
- 11 Border Management

V. SECURITY AND DEFENCE €27.5

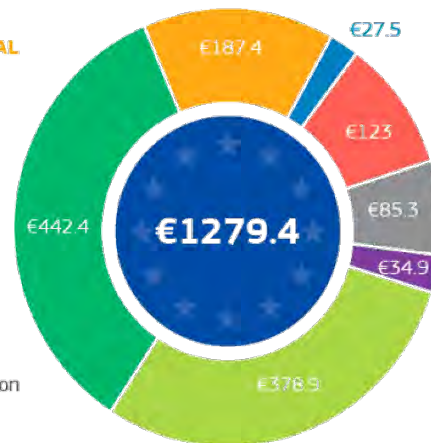
- 12 Security
- 13 Defence
- 14 Crisis Response

VI. NEIGHBOURHOOD AND THE WORLD €123

- 15 External Action
- 16 Pre-Accession Assistance

VII. EUROPEAN PUBLIC ADMINISTRATION €85.3

- 17 European Public Administration



Source: european Commission

**Thank you very much
for your attention!**



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Thank you very much
for your attention!



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The UPV is the only technological Spanish university listed among the best in the world.
Academic Ranking of World Universities, University of Jiao Tong, Shanghai

