

www.snap4city.org www.snap4solutions.org











Al Digital Twin Platform to set-up Sustainable Decision Support Systems & Business Intelligence

> #snap4city #km4city #disitlab @snap4city







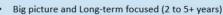


Main Tasks



- Controlling Status: management, and operational
 - Monitoring via KPI
 - Computing predictions data from the field and KPI
 - Anomaly detection
 - Early warning on critical conditions
- Making plan: tactic and strategic, medium and long range
 - Optimisation: Prescriptions, suggestions
 - Risk assessment
 - What-if analysis on scenarios
 - Simulation and predictions
 - Resilience
- Be ready for Unexpected Unknows

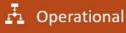




- · Vision, Mission, Why, Policies and Direction
- Executive-management
- · What is the right direction for the company?



- Short-term focused (3 months to 2 years)
- Focused on specific business department
- Middle-management
- · What activities to be planned in strategic alignment?



- Focused on day-to-day running
- Detail level processes for specific outcomes
- Execution by teams and managers
- Are we acting in alignment with strategy?





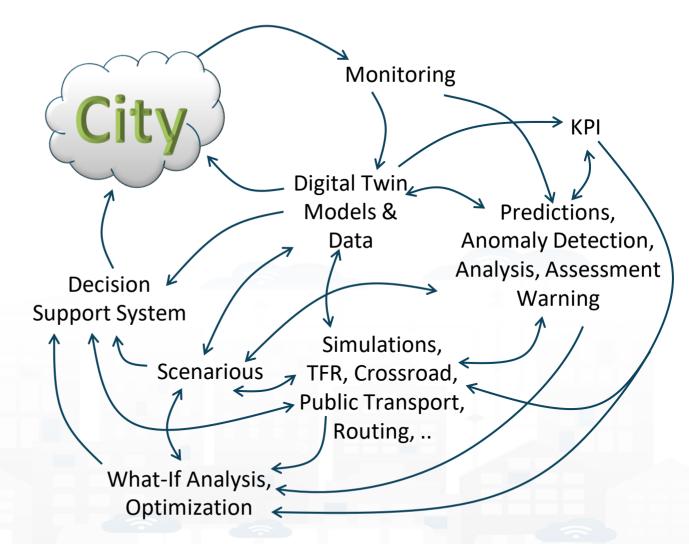




Main tasks



- Controlling Status: management, and operational
 - Monitoring via KPI
 - Predictions vs KPI
 - Anomaly detection
 - Neuro-Symbolic analysis
 - Risk assessment
 - Early warning on critical conditions
 - Fast What-if analysis
- Making plan: tactic and strategic, medium and long range, micro/macro
 - Simulation & optimization
 - Generative AI Prescriptions, scenarios
 - Resilience to Unexpected unknows
 - What-if analysis wrt scenarios
 - Collaboration with stakeholders

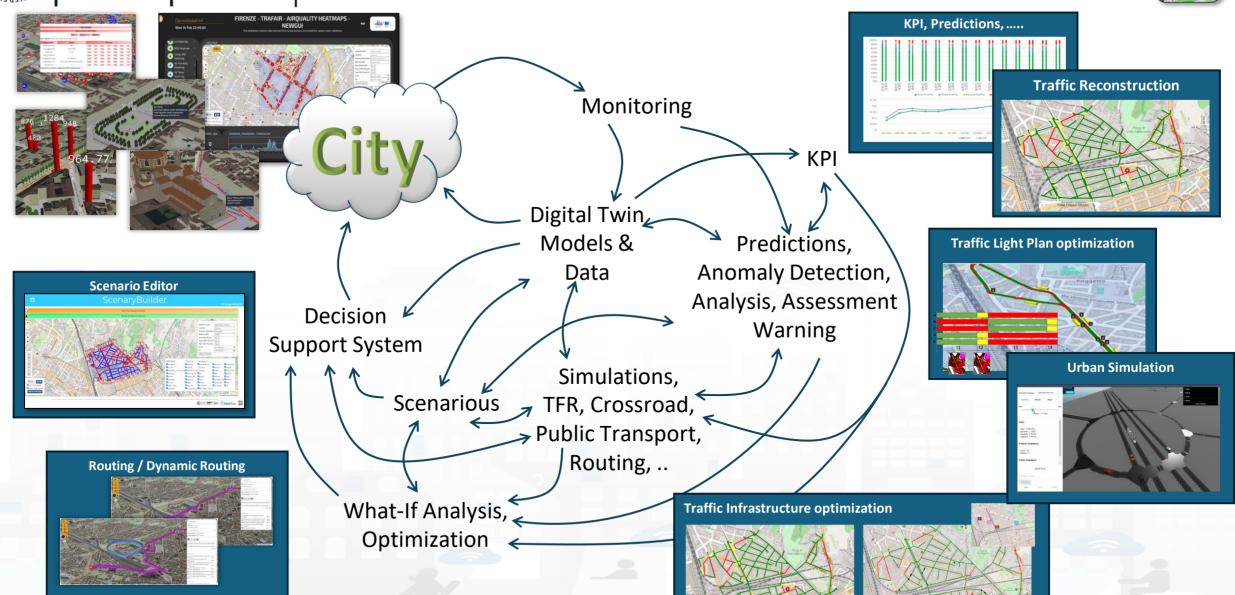












Snap4City (C





FREE



















EXPERT SYSTEM, KNOWLEDGE BASE

SEMANTIC REASONING

SMART DATA MODEL

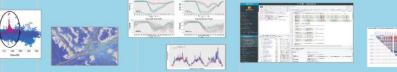
IOT DEVICE MODELS, STORAGE

Digital Twin Solutions for Sustainability

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS











VISUAL PROGRAMMING, ADAPTERS
DATA FLOWS, WORKFLOWS
PARALLEL DISTRIBUTED PROCESSING
DATA DRIVEN



- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES
- LIVING LABS
- GUI CUSTOM STYLES
- FULL APPLICATIONS, DASHBOARDS
 AND VIEWS
- · MOBILE APPS











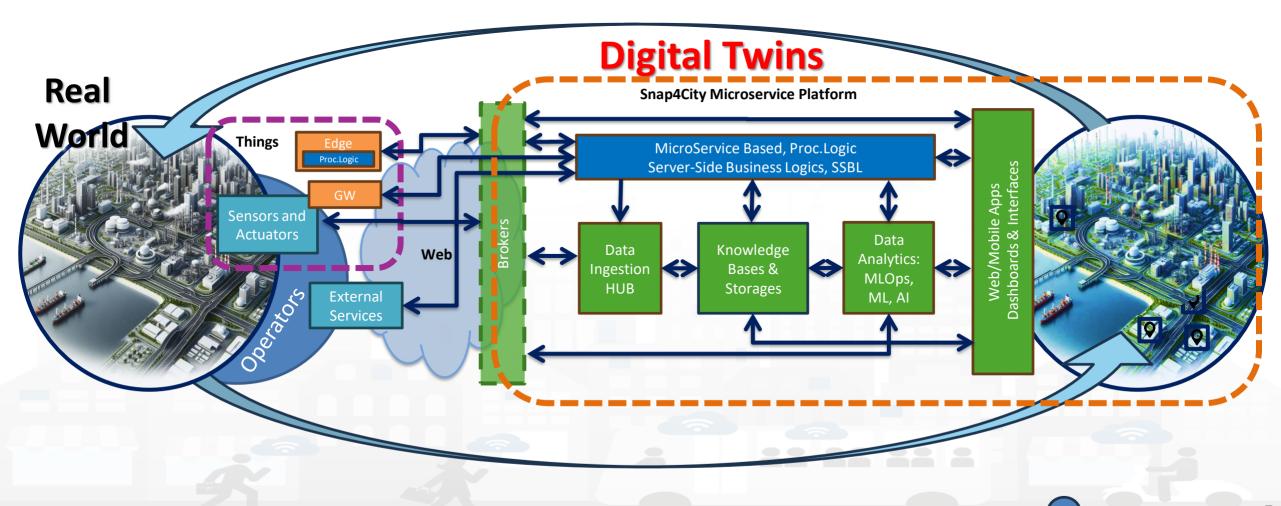








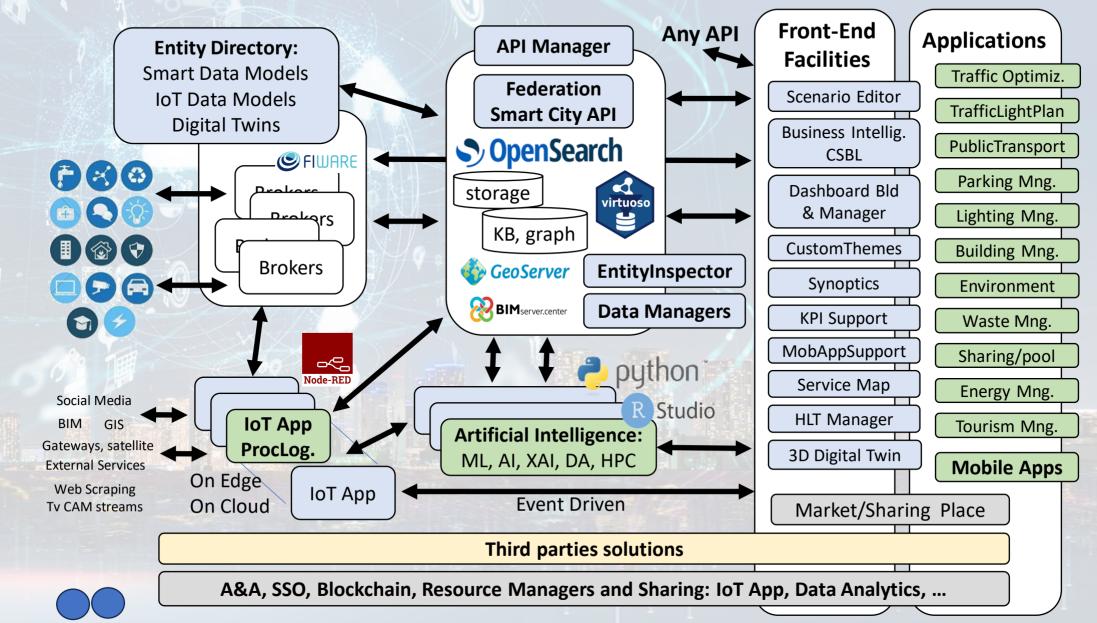
Digital Twin Development Platform



Technical Architecture



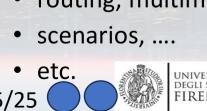




High Level Types

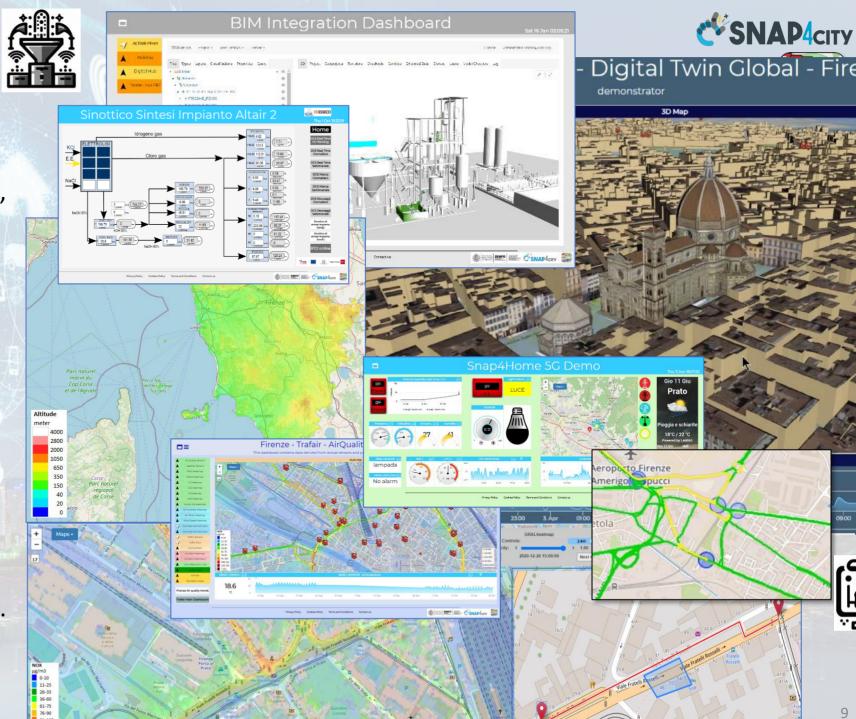
Snap4City (C), June 2025

- POI, IOT Devices, shapes,...
 - FIWARE Smart Data Models,
 - IoT Device Models
- GIS, maps, orthomaps, WFS/WMS, GeoTiff, calibrated heatmaps, ..
- Satellite data, any kind...
- traffic flow, typical trends, ...
- Vector fields + heatmaps, ...
- trajectories, events, workflow, ...
- 3D Models, BIM, Digital Twins, ...
- OD Matrices of several kinds, ...
- Dynamic icons/pins, ...
- Synoptics, animations, ..
- KPI, personal KPI,...
- social media data, TV Stream,
- routing, multimodal, constraints, ...









Standards and Interoperability

SNAP4city

Compliant with:

- **IoT:** NGSI V2/LD, LoRa, LoRaWan, MQTT, AMQP, COAP, OneM2M, TheThingsNetwork, SigFOX, Libelium, IBIMET/IBE, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Protocol Buffer, KNX, OBD2, Proximus, ..
- IoT model: FIWARE Smart Data Model, Snap4City IoT Device Models
- **General**: HTTP, HTTPS, TLS, Rest Call, SNMP, TCP, UDP, SOAP, WSDL, FTP, FTPS, WebSocket, WebSocket Secure, GML, WFS, WMS, WCS, RTSP, ONVIF, AXIS TVCam, CISCO Meraki, OSM, Copernicus, The Weather Channel, Open Weather, OLAP, VMS Milestone, TIM, HERE,
- Formats: JSON, GeoJSON, XML, CSV, GeoTIFF, OWL, WKT, KML, SHP, db, XLS, XLSX, TXT, HTML, CSS, SVG, IFC, XPDL, OSM, Enfuser FMI, Lidar, glTF, GLB, DTM, GDAL, Satellite, D3 JSON, ...
- Database: Open Search, MySQL, Mongo, HBASE, SOLR, SPARQL, ODBC, JDBC, Elastic Search, Phoenix, PostGres, MS Azure, ...
- Industry: OPC/OPC-UA, OLAP, ModBUS, RS485, RS232,...
- Mobility: DATEX, GTFS, Transmodel, ETSI, NeTEx, ...
- Social:Twitter, FaceBook, Telegram, ...
- Events: SMS, EMAIL, CAP, RSS Feed, ...
- OS: Linux, Windows, Android, Raspberry Pi, Local File System, AXIS, ESP32, etc.

























https://www.snap4city.org/65





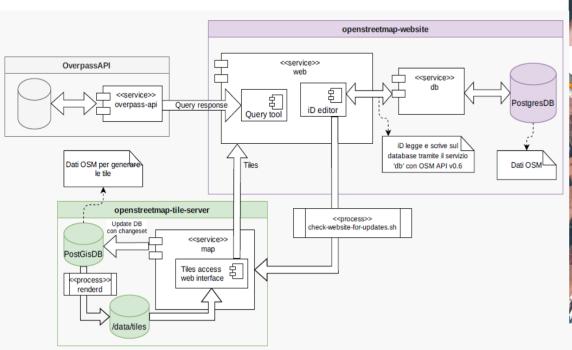


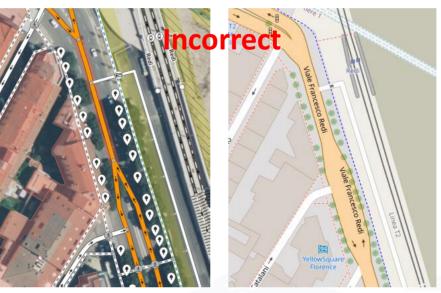




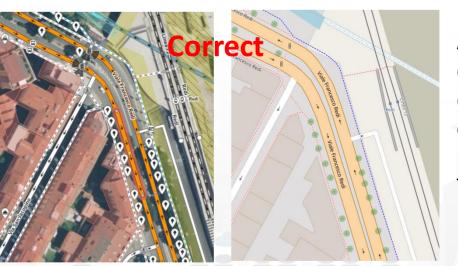


Correcting road graphs from OSM





OSM data with non clear double bidirection lane on Viale Redi, Florence.
Editing OSM data and present Tiles



After Corretion of OSM data defining a clear double bidirection lane on Viale Redi, Florence. Regeneration of the TILEs for the maps



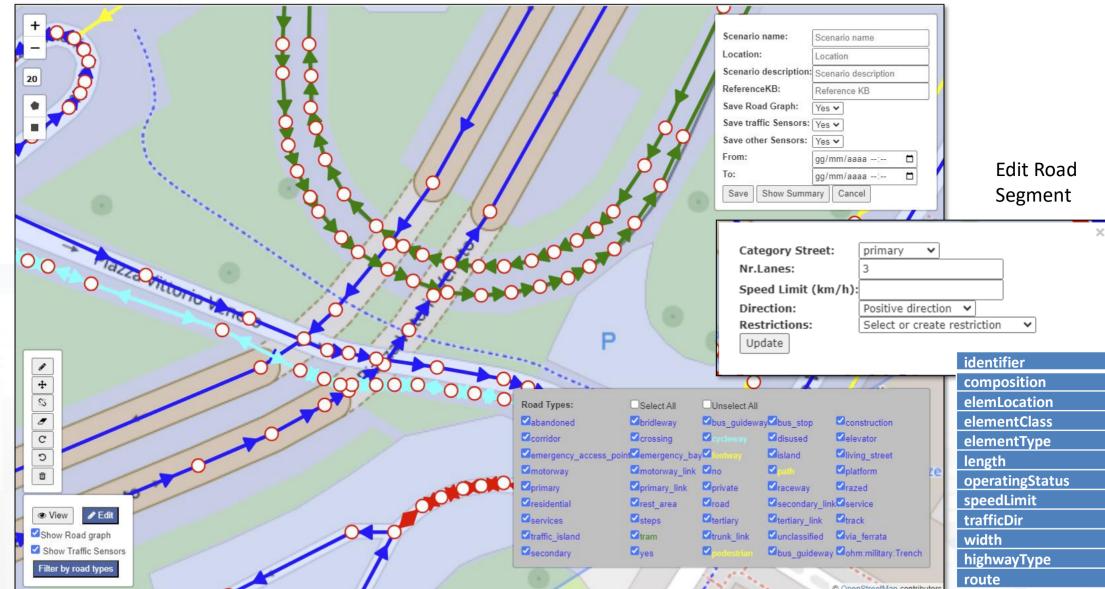








Select map 700m



New Scenario

Editing Drag & drop Split & Join Delete Do and Undo

Ingestion, aggreg. > exploitation

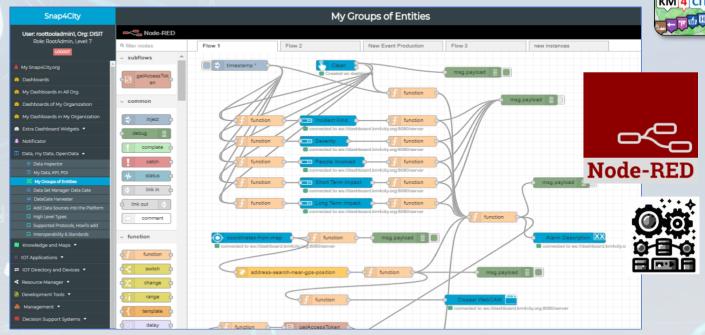


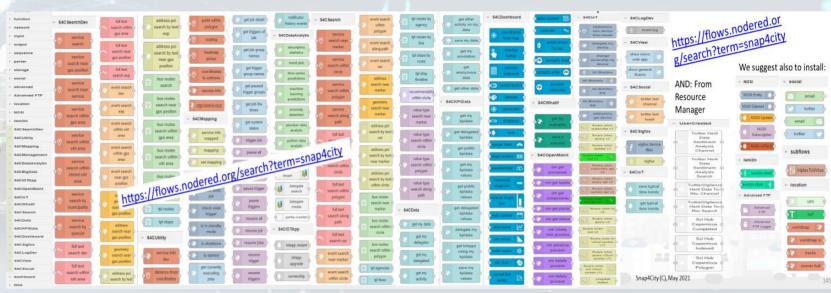






- IoT App Visual Programming, no coding
 - Data transformation
 - Integration, Interoperab.
 - Scripting Data Analytics
 - Data ingestion
 - Business logic Server Side
- Edge and Cloud
- MicroServices data event driven develop via visual language Node-RED













> 60.000 downloads (up to 2024)

Areas

Open Data CKAN Ticket Management, workflow **BIM Servers** Social Networks Video Management system Gateways

Data Analytics Statistic, Optimization Simulation **Artificial Intelligence** What-if Analysis Support Geo Utilities Support **Routing & Traffic Flow MLOps** support Python support R Studio Support

Entities Managemen Visualitation Serile to de distriction **Snap4City** Microservices M_{ana}gement Analytic Services Platform Proc.Logic **SSBL** other Third Party microservices

Data Load / Search / Retrieval KPI, POI, GIS Data, Scenarios Time Series, Public transport High Level Types: heatmaps, ODM,... IoT / Entity Discovery **Delegation Management Data Mapping**

> **Dashboards** Widgets: Graphic Libraries **Interactive Widgets** Maps, 3D representations Synoptics, External Content Micro Web App

IoTApp Management Data Logs, A&A, Security Ownership Management **VPN** remote access

Expert System semantic queries

UNIVERSITÀ DEGLI STUDI FIRENZE







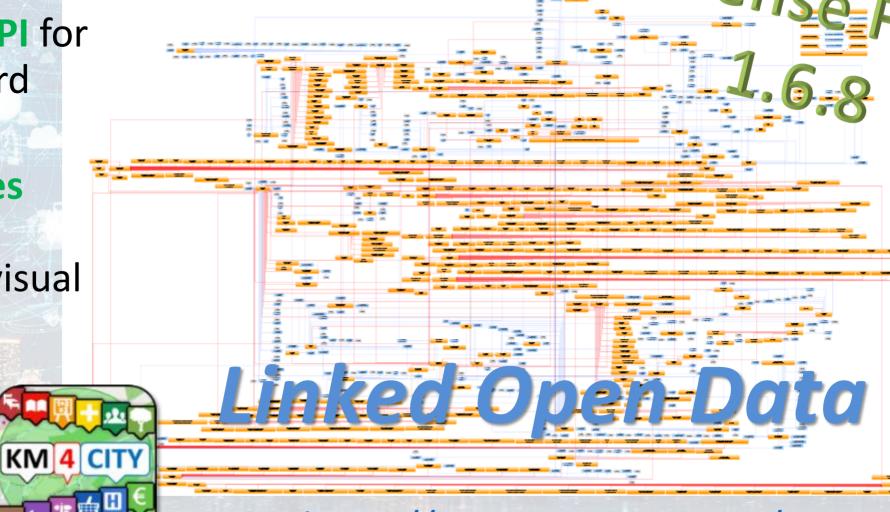
· via:

 Smart City API for Apps and third party

MicroServices
 data driven
 develop via visual
 language
 Node-RED







https://www.snap4city.org/19





Km4City Ontology elements 1.6.8

- **Km4C**: Km4City 1.6.8
- Using
 - DCTERMS: for metadata Dublin Core Metadata Initiative
 - FOAF: friends of a friends
 - Good Relation: entities relationships
 - iot-lite: IOT Vocabuary
 - OTN: Ontology of Transportation Networks
 - OWL-Time: time reasoning
 - SAREF Smart Appliances REFerence extension for building devices available at https://saref.etsi.org/saref4bldg/
 - Schema.org for people and organizations
 - SSN: Semantic Sensor Network Ontology (see https://www.w3.org/TR/vocab-ssn/
 - WGS84 Datum of Geo-Objects
 - GTFS, General Transit Feed Specification, and Transmodel, for public transport infrastructures: lines/rides time schedules, real-time records, paths, etc.;
 - BOT: Building Topology Ontology. https://w3c-lbd-cg.github.io/bot/
 - S4CITY: SAREF extension for Smart City. https://saref.etsi.org/saref4city/v1.1.2/







Available AI Solutions on Snap4City

SNAP4city

nnlic

https://www.snap4city.org/997

More than 80 Available Solutions & 300 Al applic.

- Mobility and Transport
- Environment, Weather, Waste, Water
- City Users Behaviour and Social analysis
- Energy and Control
- Tourism and People
- Security and Safety
- High Level Decision Support Solutions
 - Asset management
 - Resilience and Risks Analysis
- Low level Techniques

https://www.snap4city.org/download/video/course/p4/



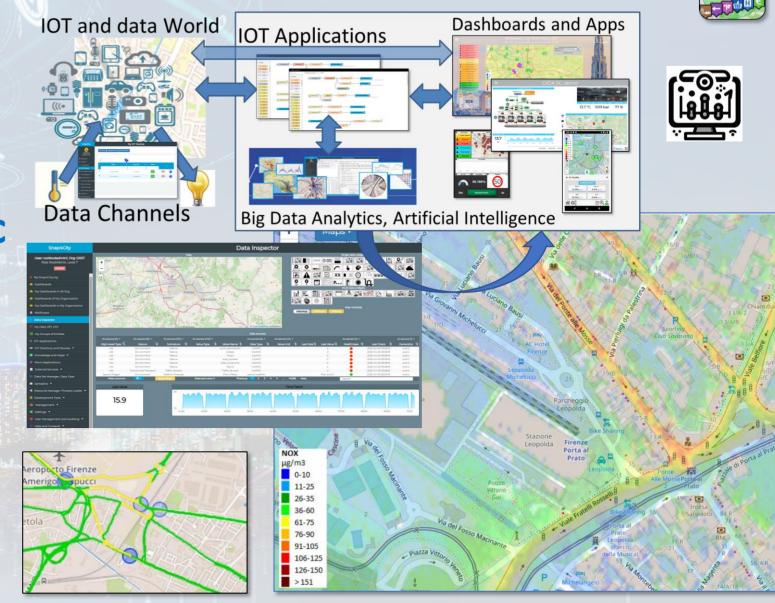


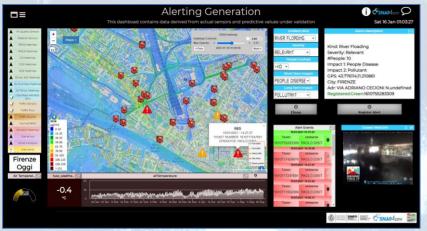
https://www.snap4city.o rg/download/video/DPL SNAP4SOLU.pdf

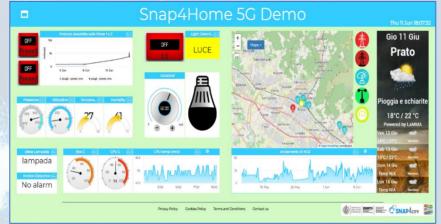
Snap4City (C), June 2025

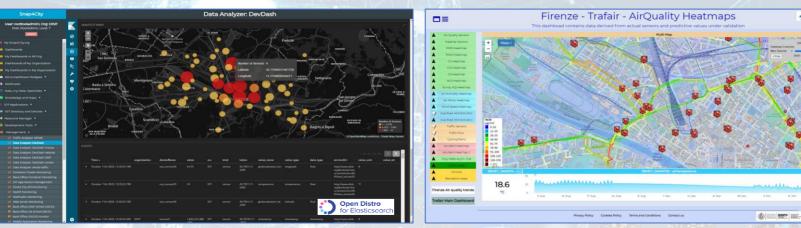
Solutions: reliable, secure and fast to realize

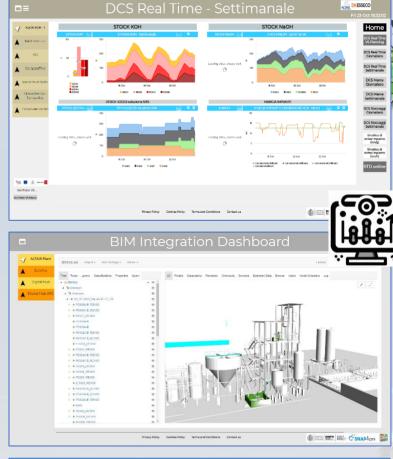
- Via Snap4City tools
 - Dashboard Wizard
 - Dashboard Builder
 - Data/Visual Analytic
- Smart Solutions results to be
 - Real time data drive
 - Secure end-to-end
 - GDPR compliant
 - Reliable, interoperable
 - Auditable, marketable



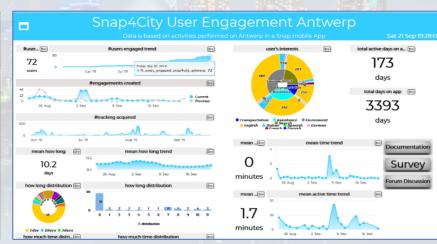


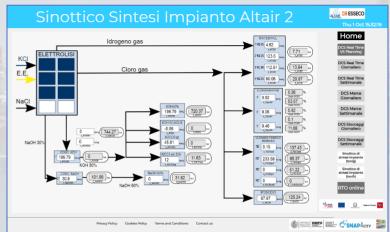


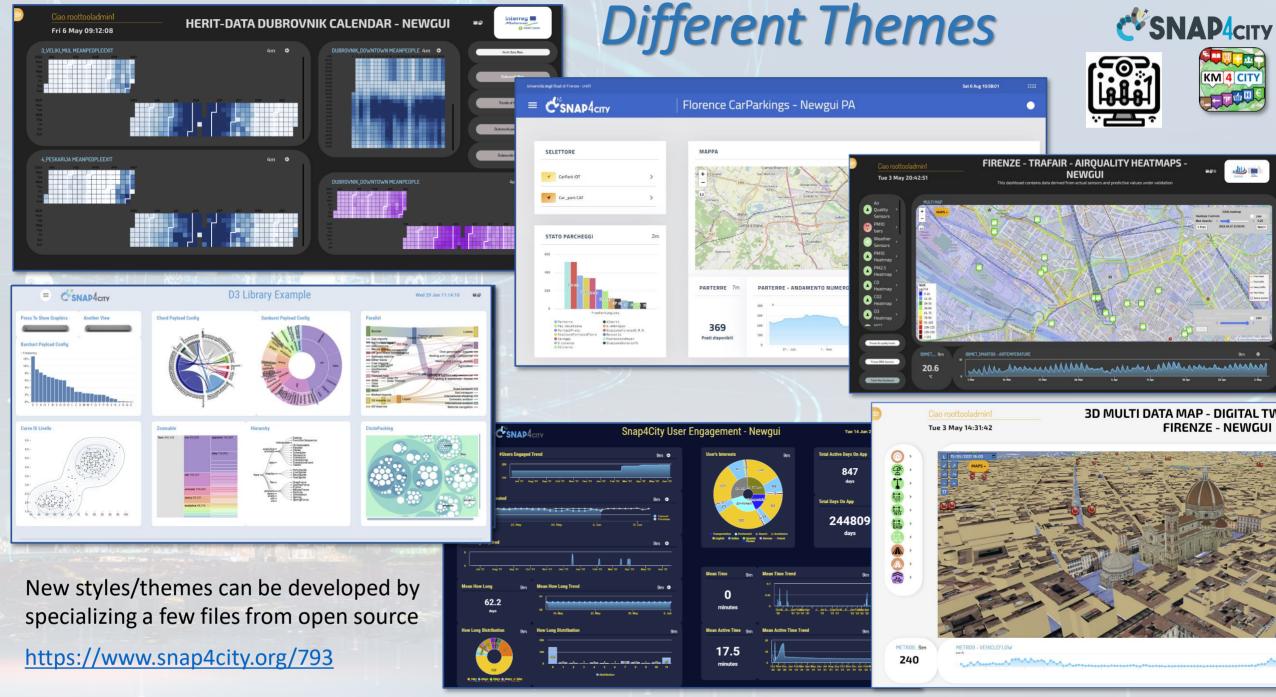












Snap4City (C), June 2025

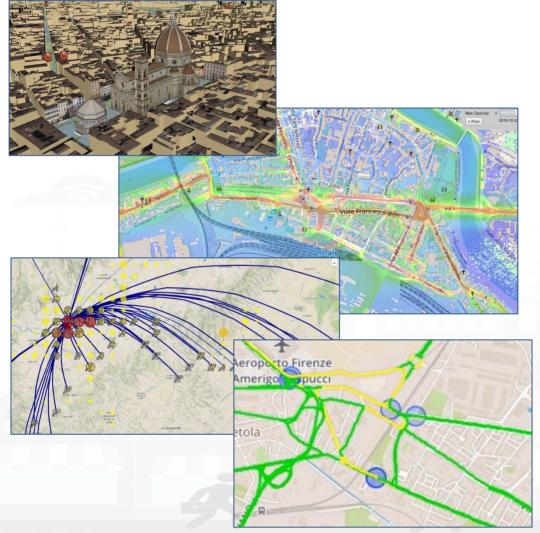








Smart City Digital Twin



City Digital Model with...

- Intuitive platform
- Any Data TYPE, any data source, any protocol
- Data storage seamless
- Data analytics → artificial intelligence, AI/XAI
- Data Ethics, AI Ethics, GDPR
- Interactive Data Representation, any kind
- Key Performance Indicators, any kind
- What-IF analysis Simulation, prediction, 2D/3D
- Micro, Meso e macro scales
- Operation, planning tactic and strategic / optimization
- Collaborative and shared representation
- Sustainable, shared, open source 100%

Complex and heterogeneous information, interoperability

- o GIS, ITS, AVM, IoT, BIM, CKAN, etc.
- Satellite services
- MaaS, last-mile delivery HUBs
- o etc.





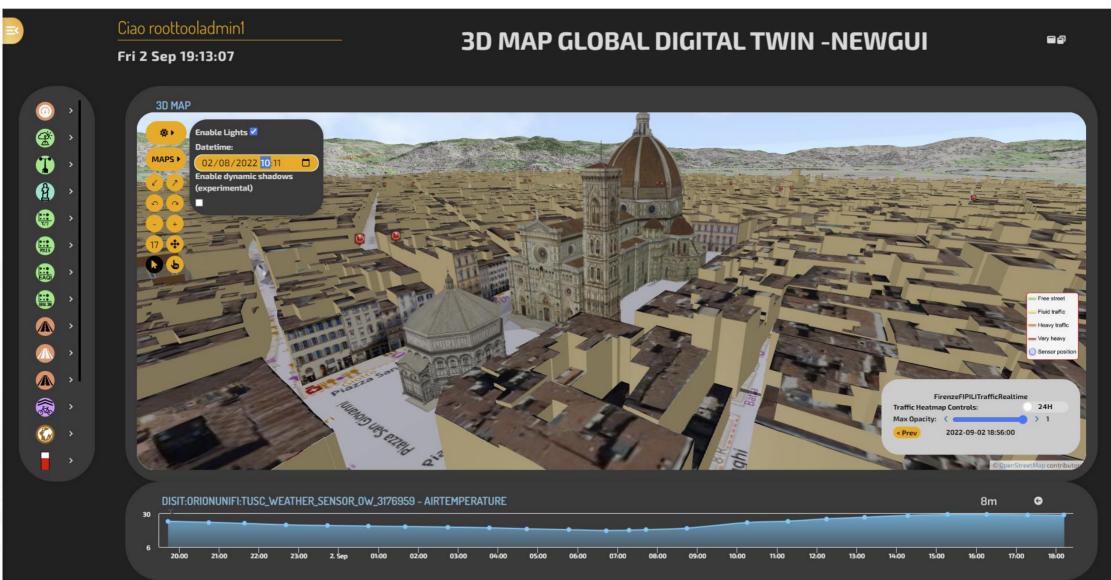












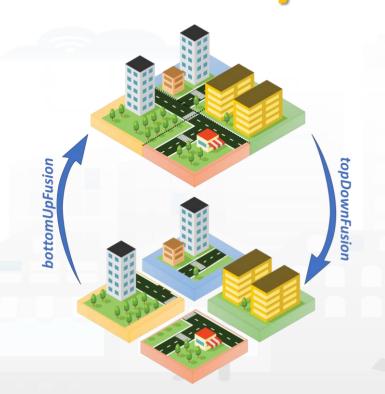


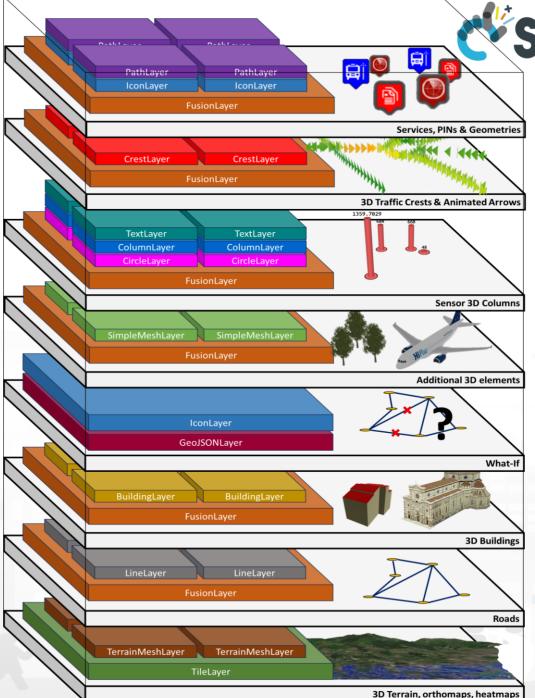




DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Layers **Fusion Layers**



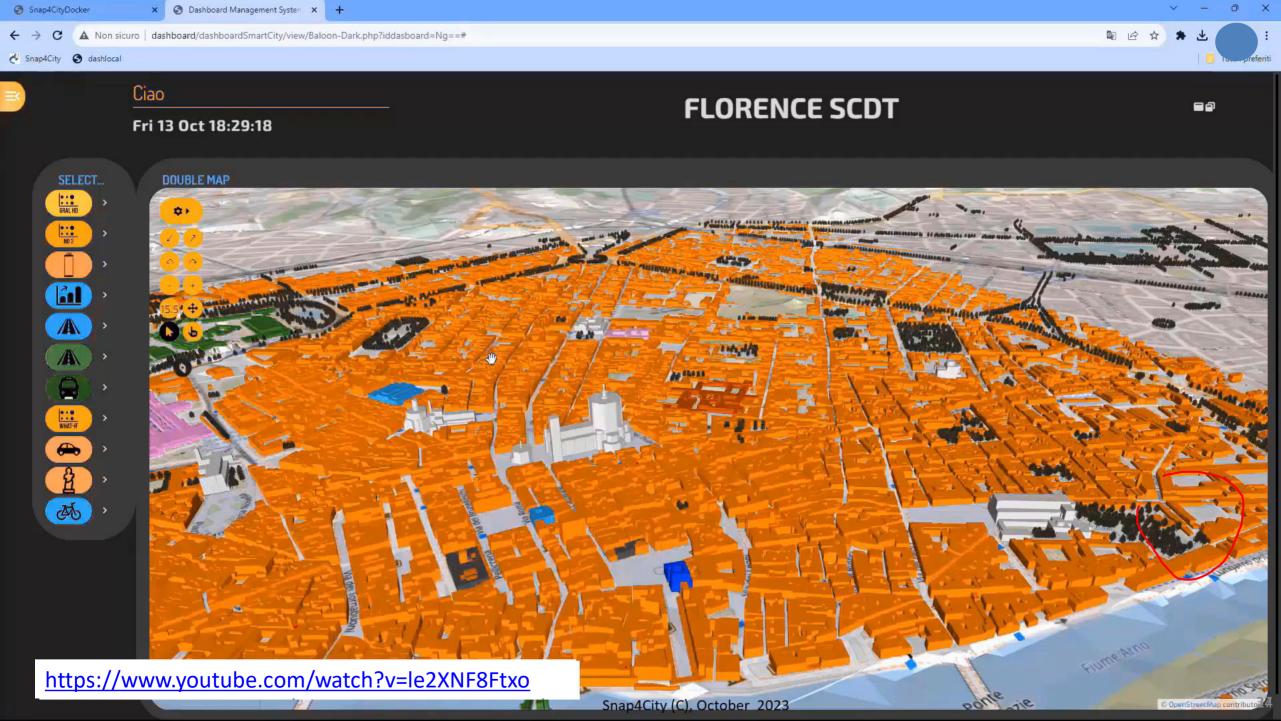






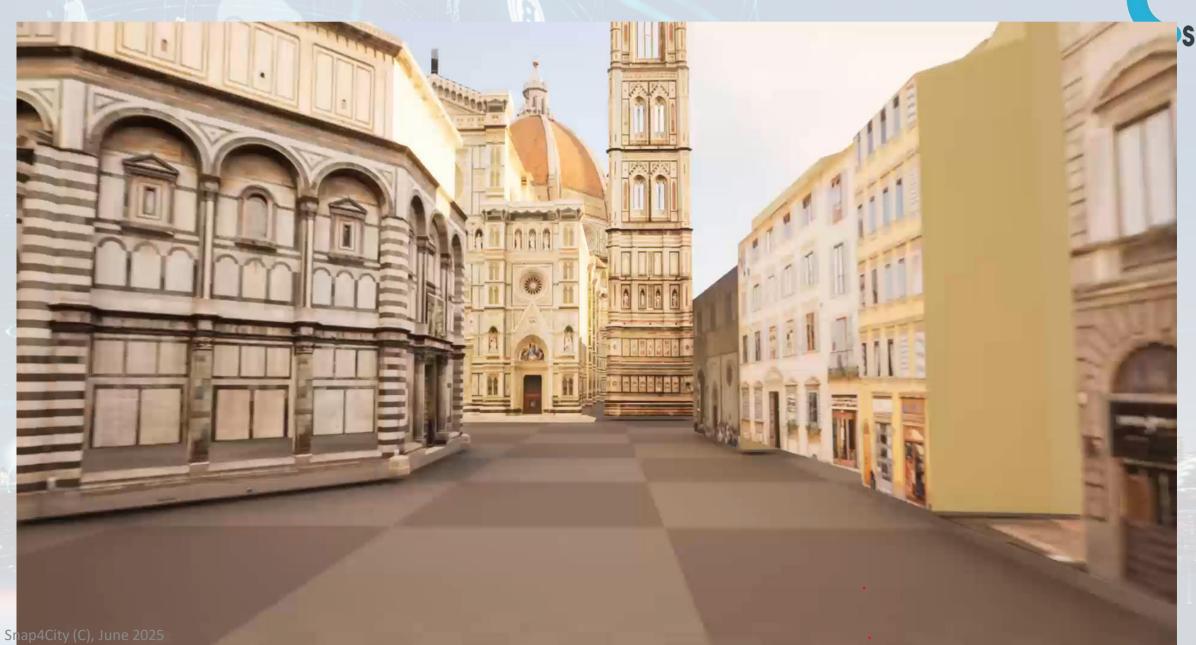






OCULUS

https://www.youtube.com/watch?v=Rcf B2 GOio



SNAP4

https://www.Snap4City.org











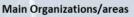


• 11 running installations in Europe

- Snap4city.org, Greece, Merano, Cuneo, ...
- Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
- Altair, Italmatic, M4F, Romania,
- 20 projects, 12 pilots on 10 Countries
 - >40 cities/area

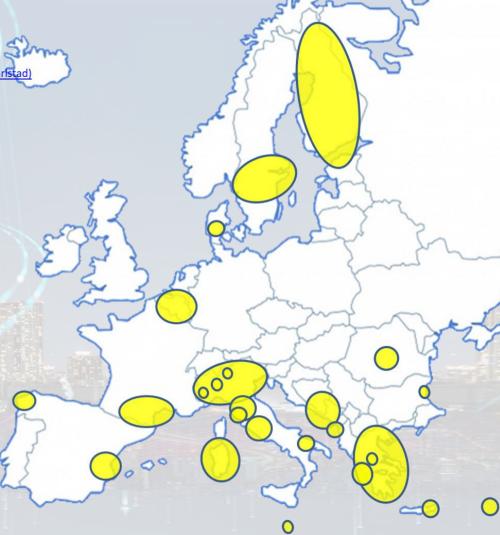
Widest MULTI-tenant deploy has

- 26 Organizations / tenant
- > 8850 users on
- > 1800 Dashboards
- > 17 mobile Apps
- > 2.2 Million of structured data per day
- > 580 IoT Applications/node-RED
- > 850 web pages with training
- > 85 videos, training videos



- Antwerp area (Be)
- Bisevo, Croatia
- Brasov (Ro), by ICEBERG
- Capelon (Sweden: Västerås, Eskilstuna, Karlsta
- DISIT demo (multiple)
- Dubrovnik, Croatia
- Firenze area (I)
- Garda Lake area (I)
- Greece (Gr)
- Helsinki area (Fin)
- Limassol (Cv)
- Livorno area (I)
- Lonato del Garda (I)
- Malta (Malta)

- Mostar, Bosnia-Herzegovina
- Oslo & Padova (Impetus)
- Pisa area (I)
- Pont du Gard, Occitanie (Fr)
- Prato(I)
- Rhodes (Gr)
- Santiago de Compostela (S)
- Sardegna Region (I)
- SmartBed (multiple)
- Toscana Region (I), SM
- Valencia (S)
- Varna (Bulgaria)
- Venezia area (I)
- WestGreece area (Gr)





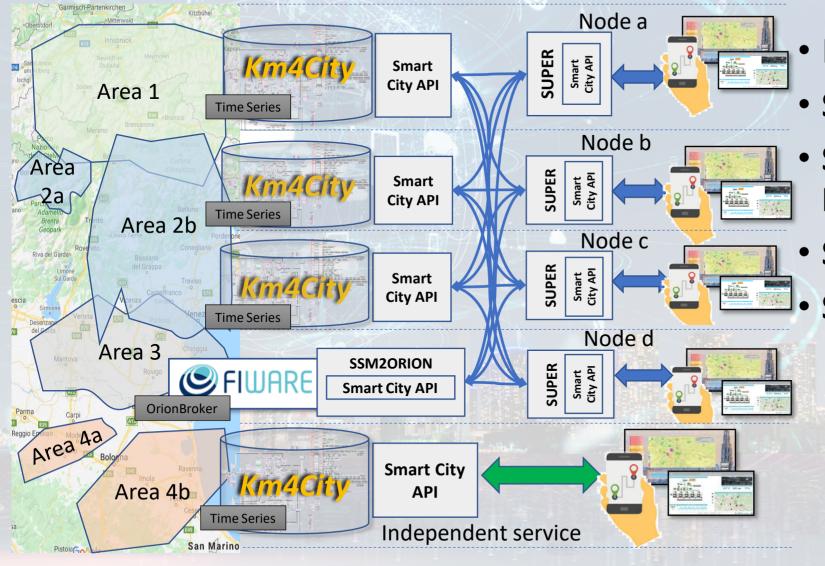


• + Israel, Colombia, Brasile, Australia, India, China, etc.

Federation of Smart City Services







- Km4City Semantic Reasoner
- ServiceMap interoperability
- Seamless for multiple Mobile Apps
- Smart City API
- Super:
 - distributed access and sharing services
 - Each city control its own data
 - Final user can pass from one city / area to another in seamless manner: without changing the mobile Apps







Scenarious



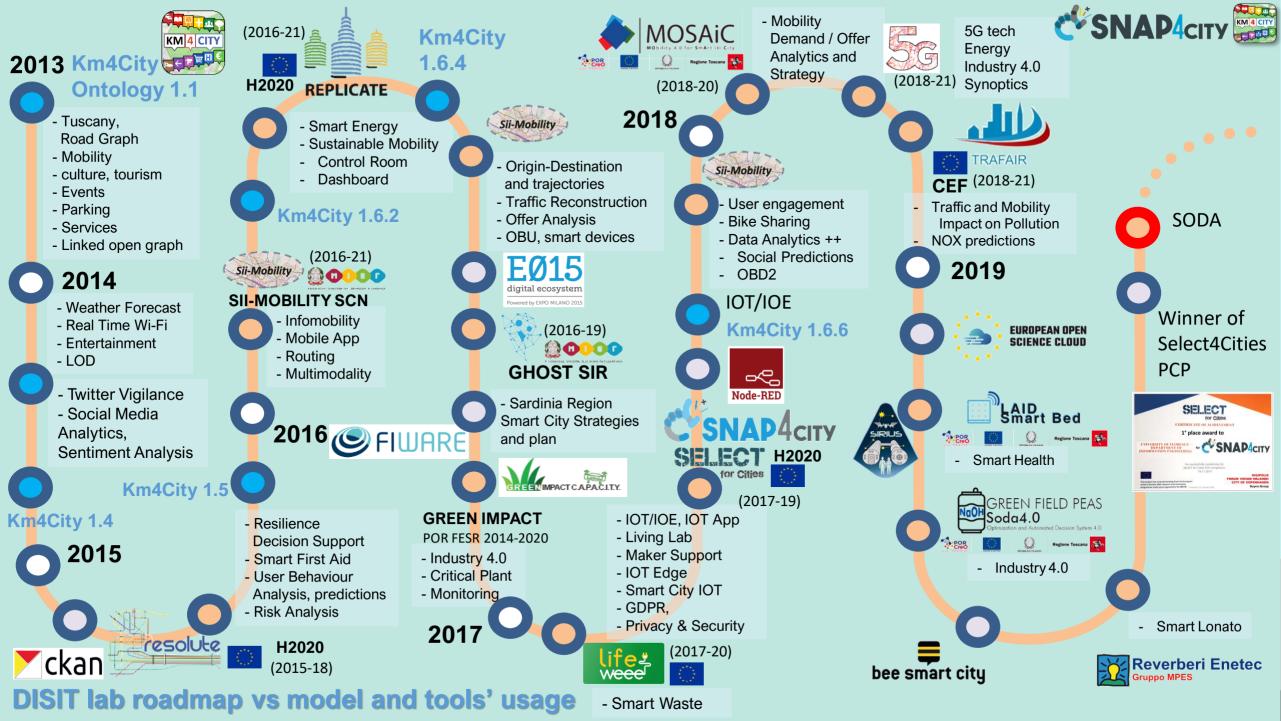
- Snap4City at OSAKA with OPTIFaaS and CN MOST
- SMART3R-FLITS: SMART Transport for TRavellers and Freight Logistics Integration Towards Sustainability
- SOLUTION: Security, Smart City Asset Management for Cuneo, Italy
- ENERGIA: R&S di autoclave a mandrini multipli nel curing di serbatoi in composito per storage di H2 mediante ottimizzazione energetica machine learning.
- UrbanDT4TF: Urban Digital Twin for Traffic Flow
- ELLIE: On the UsE of Internet of Senses for the Cultural Heritage
- Snap4Rhodes: The "Single Smart City & Cyber Security Monitoring Platform" for the Municipality of Rhodes
- SADI-MIAC: Integrated Decision Support System with Digital Twin Models and Artificial Intelligence for Business
- SADI-MIAC: Sistema di Assistenza alle Decisioni Integrato con Modelli Digital Twin e Intelligenza Artificiale per le attività commerciali SCENARIO: City Users' Participation and Engagement with Snap4City.
- OPTIFaaS: Operation and Plan, Transport Infrastructure and Facilities Support as a Service
- SOLUTION: 15MinCityIndex: understanding city areas by means of 13 different aspects. PDF
- SOLUTION: Energy Management and Control
 DE
- SOLUTION: Environment Control Predictions & Prescriptions
- SOLUTION: Smart Light Control and Light Adaptive with Traffic Density
- SOLUTION: Smart Tourism Management with Snap4City
- SOLUTION: Traffic Infrastructure Optimisation: reducing travel time and emissions
- SOLUTION: Traffic Light Plan Optimisation: reducing travel time, number of stops for vehicles and tramway lines: PDF
- SOLUTION: Snap4Building: monitoring, managing, controlling infrastructures
- SOLUTION: Snap4City integration with Milestone X Protect, VMS, Video Management System PDF
- SOLUTION: Snap4City Digital Twin, PDF
- SOLUTION: eShare in a Snap The innovative car sharing and car pooling service, PDF
- SOLUTION: Snap4City Smart Parking Manager and mobile App supports PDE
- SOLUTION: Exploit Snap4City in different Smart Waste use cases, waste manager.
- eShare in a Snap The innovative car sharing and car pooling service
- Digital Twin Cityverse FAO to Snap4City
- AMMIRARE: make the beach system more resilient to climate change risks through the implementation of natural based solutions
- TOURISMO: TOURism Innovative and Sustainable Management of flows
- CAI4DSA: Collaborative explainable neuro-symbolic AI for Decision Support Assistant
- SASUAM: Solutions for Safe. Sustainable and Accessible Urban Mobility

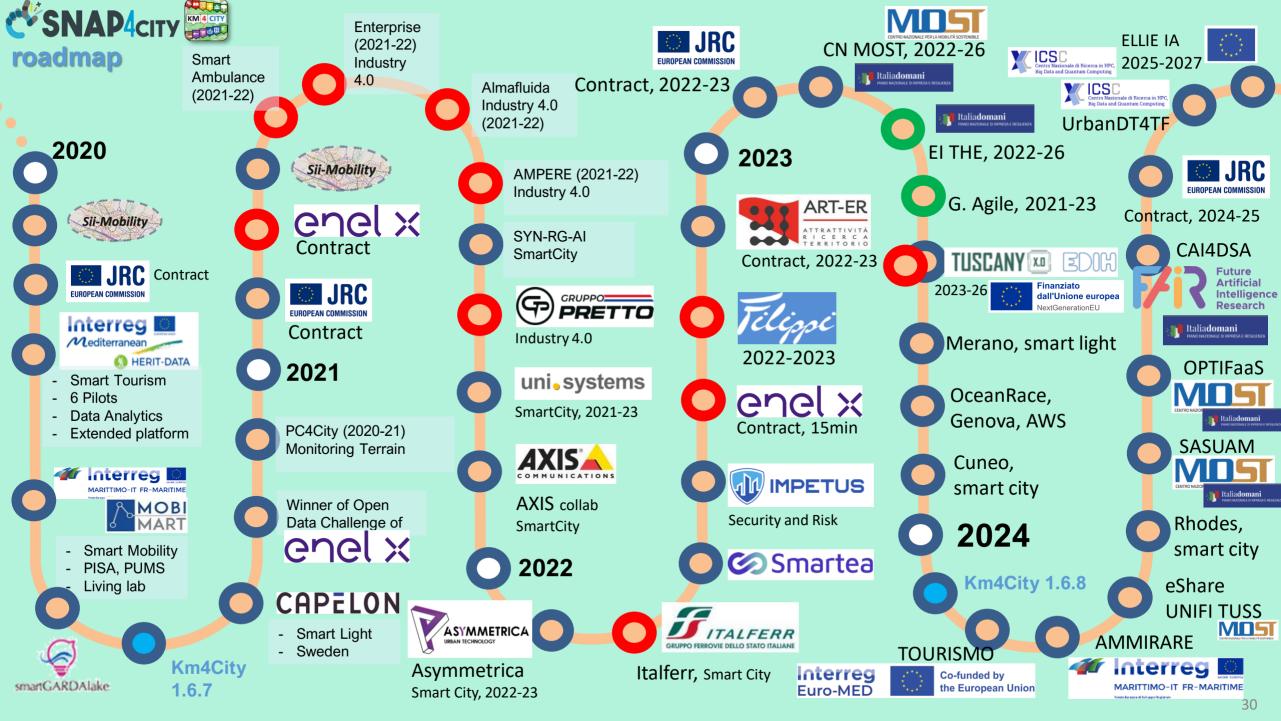
for Traffic Density (the actual case of Merano)

- tà e trasporti, MaaS, parcheggi, inquinamento (ITA)
- Snap4City integration with Milestone X Protect, VMS, Video Management System PDF
- SCENARIO: Smart Light Control, 2023, CAPELON, PDF
- Florence HeritData FactSheet: https://www.snap4city.org/drupal/sites/default/files/files/FACTSHEET%20FLORENCE.pdf
- SCENARIO: Smart City Living Lab in Romania, PDF
- Snap4PVenergy: Online Photovoltaic System Simulator
- SCENARIO: Fashion Retail Recommendation System via Multiple Clustering Approach
- SCENARIO: Energy Community, CER, SELFUSER
- SCENARIO: Supporting Decision Makers in Real Time about Quality Lab Analyses on the production process, PDF
- Herit-Data and Snap4City: to better manage tourism flows, PDF
- Digital Twin Local and Global, PDF
- Social Media Analysis: Twitter Vigilance, PDF
- GDPR Compliant People Detection and Counting using Thermal Cameras, PDF
- Artificial Intelligence Predicts Landslides in Florence Area, PDF
- Available Parking Slots Prediction, PDF
- Available Bikes and Free Slots Prediction On Bike Sharing Stations, PDF
- Long Term Prediction of NO2 KPI of European Commission reference values, PDF
- Inventory of transferable digital applications and solutions for the tourism ecosystem
- Scenario: AMPERE Operator 4(2): 7(C), June 2025
 - Ethics and Technology for Urban Safety (Oslo and Padova)











++2024/25



- UrbanDT4TF, CN HPC: Digital Twin mobility, https://www.snap4city.org/drupal/node/1057
- **DI-DTPlatform**, CN HPC: Digital Twin, mobility, environment, https://www.snap4city.org/drupal/node/1097
- Sasuam, CN MOST, PNRR: AI, mobility, https://www.snap4city.org/drupal/node/999
- **OPTIFaaS**, CN MOST, PNRR: AI, mobility, DSS, https://www.snap4city.org/drupal/node/1008
- LeverageOPTIFaaS, CN MOST: PNRR, mobility, https://www.snap4city.org/drupal/node/1064
- TOURISMO, Interreg, EC: Tourism, NLP, DSS, https://www.snap4city.org/drupal/node/1001
- **ELLIE**, Horizon Europe, EC: AI, VR, https://www.snap4city.org/drupal/node/1056
- CN MOST, PNRR: sustainable mobility, platform, https://www.snap4city.org/drupal/node/1050
- ISPRA JRC contract, EC: DSS, SOC, control room, energy, https://www.snap4city.org/drupal/node/970
- AMMIRARE, Interreg, EC: AI, environment, Big Data, https://www.snap4city.org/drupal/node/1002
- CAI4DSA, FAIR PE1, PNRR: AI, Neuro-Symbolic, PINN, NG-DSS, https://www.snap4city.org/drupal/node/1016
- SADI-MIAC, RT, partner: AI, Tourism, Retail, Computer Vision, https://www.snap4city.org/drupal/node/1055
- PRIN UNICagliari, SMART3R: mobility, DSS, https://www.snap4city.org/drupal/node/1087
- Tuscany X.0, EDIH, TestBeforeInvest, Training on AI, Big Data, Security, HPC: https://www.tuscanyx.eu/
- The IE, PNRR: AI, NLP, Legal Aspects
- Energia, RT, conv: AI, PINN, DSS
- **RFI contract**: mobility, AI, DSS
- Salerno Port: for container ID recognition
- Talent Hub, ECRF, conv: NLP, match demand vs offer
- + currently: Merano, Salerno, Cuneo, Rhodes, Reverberi, Florence, IDTS, ALTAIR, etc.



booklets

SNAP4city

KM 4 city

Smart City





https://www.snap4city.org /download/video/DPL_SN AP4CITY.pdf Industry





https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY.pdf

• Artificial Intelligence





https://www.snap4city.o rg/download/video/DPL SNAP4SOLU.pdf



Control Planning

Control

Management and Operational (monitoring, KPI, anomaly detection, early warning)

Planning

Tactic and strategic, medium and long range, micro/macro (simulations and predictions, what-if analysis)





FREE TRIAL







TEMPLATES

EXPERT SYSTEM, KNOWLEDGE BASE

SEMANTIC REASONING

SMART DATA MODEL

IOT DEVICE MODELS, STORAGE













Digital Twin Solutions for Sustainability

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS









BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE EXPLAINABLE AI, MACHINE LEARNING, GENERATIVE AI OPERATIVE RESEARCH, STATISTICS



VIDEO - REPORTS - MAPS - 3D ...



- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES
- LIVING LABS
- GUI CUSTOM STYLES
- FULL APPLICATIONS, DASHBOARDS
 AND VIEWS
- MOBILE APPS



















Control Horizontal Platform

- Increasing quality of Life, quality of services,
- Decongestion, Decarbonization, Sustainability
- increase efficiency and production optimization
- Improve accessibility to services: citizens, Tourists, commuters, etc.
- Improve security/Safety of city users, risk reduction
- Costs reduction of services, energy consumption reduction
- Reduction of emissions and EC taxations

Horizontal homogeneous platform Uniform Technology for

- Any Vertical operation/plan: mobility, energy, environment, security, tourism, infrastructure and assets control, buildings, etc.
- Al Solutions: early warning, predictions, simulations, what-if, optimization; Deep Learning, ML, BERT, LLM, XAI (Shap/Lime),
- Development Environment for any vertical, Digital Twin: City Global and Local, IoT, VR, Visual Programming, business intelligence, CSBL, SSBL, etc.
- Interoperability: any format, any protocol, any video management system, any sensor, any device, etc.
- KPI: multidomain KPI, general management, early warning, early detection of critical conditions, 15 Min City Index, SDG
- Mobile App: modular applications, operators' modules, multiple cities, etc.
- **Participatory**: problem reporting, ticketing, etc.
- Integration of any kind









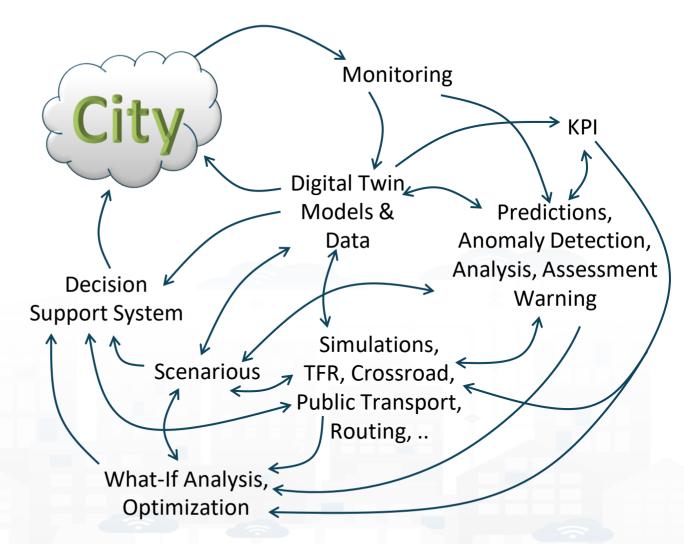


Main tasks



Controlling Status: management, and operational

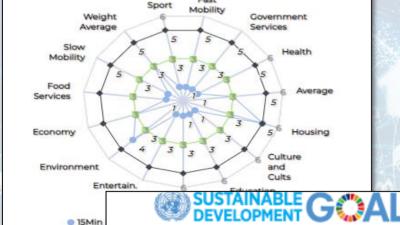
- Monitoring via KPI
- Predictions vs KPI
- Anomaly detection
- Neuro-Symbolic analysis
- Risk assessment
- Early warning on critical conditions
- Fast What-if analysis
- Making plan: tactic and strategic, medium and long range, micro/macro
 - Simulation & optimization
 - Generative Al Prescriptions, scenarios
 - Resilience to Unexpected unknows
 - What-if analysis wrt scenarios
 - Collaboration with stakeholders



Key Performance Indicators, KPI



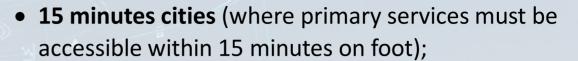




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• 15Min	SUSTAINABLE GOALS DEVELOPMENT GOALS							
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The state	140	WHOguidelines			
Pollutant	Averaging period	Objective and legal nature and concentration	Comments	Concentration	Comments
PM _{2.5}	One day			25 μg/m³ (*)	99 th percentile (3 days/year)
PM _{2.5}	Calendar year		rget value has become a lue since 1 January 2015	10 μg/m³	
PM ₁₀	One day	Limit value, 50 µg/m³ Not to be exceeded on more than 35 days per year.		50 μg/m³ (*)	99 th percentile (3 days/year)
PM ₁₀	Calendar year	Limit value, 40 μg/m³ (*)	20 μg/m³		
D ₃	Maximum daily 8-hour mean	Not to be exceeded on more Target value, 120 µg/m³ than 25 days per year, averaged over three years		100 µg/m³	
NO ₂	One hour	Limit value, 200 µg/m³ (*) Not to be exceeded more than 18 times a calendar year		200 μg/m³ (*)	
NO ₂	Calendar year	Limit value, 40 μg/m³		40 μg/m³	

• United Nations Sustainable Development Goals, **SDGs** (for which cities can do more to achieve some of the 17 SDGs, https://sdgs.un.org/goals);



objectives of the European Commission in terms of pollutant emissions for: NO2, PM10, PM2.5 (https://environment.ec.europa.eu/topics/air en);

- SUMI: mobility and transport vs env
 - https://www.snap4city.org/951
- SUMP/PUMS: mobility and transport vs env.
- ISO indicators: city smartness, digitization, tech level.
- Low Level/Real Time: global traffic, quality of service, betweenness, centrality, queue, time to travel, etc.

Periodic

15MinCityIndex

What would support my neighborhood to become a 15-Minute City?

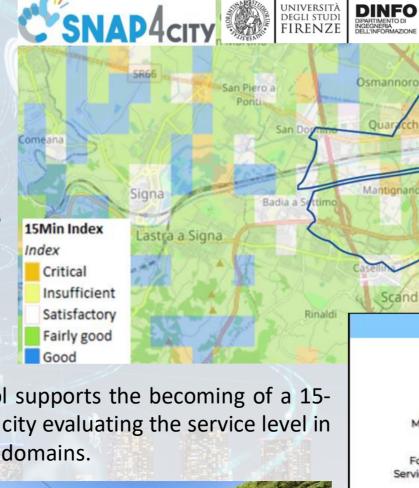
Using the Open Data:

We developed a data analytic tool based on municipal and national open data to assess services adequacy for people living in each 15 minutes areas of the city.

Good public transport services: bus, new tram line, train stations, cycle paths.



Careggi/Rifredi is a relevant district in Florence because of hosting the main Florence/Tuscany hospitals Careggi and Meyer, but also university headquarters and many other workplaces.



The tool supports the becoming of a 15-Minute city evaluating the service level in various domains.





https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjkzOA==

Snap4City (C), June 2025

15MinCityIndex on Bologna







1 NO POVERTY **15 MINUTI INDEX BOLOGNA CITTÀ** Ciao roottooladmin1 enel x **METROPOLITANA - NEWGUI ###** Tue 3 May 20:14:59 Argelato : Via Casadio N. 1 SELECTOR - MAP # of Inhabitants 3 GOOD HEALTH AND WELL-BEING Green factor 24H KIVIAT 4m Civil factor 2021-03-11 15:00:00 Industrialization 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE Environment 15Min Economy 15Min Housing 12 RESPONSIBLE CONSUMPTION 15Min Food Index > BAR SERIES 15Min Education # of inhabitants 15Min Slow Mob 10 - 50 50 - 100





650 - 800 800 - 950

>950

THE PICKED POINT

Address: Via Casadio N. 1















• 15 Minute City Index:

 13 subindexes: energy, slow mobility, fast mobility, housing, economy education, culture and cults, health, entertainment, gov, food, security...



- Optimization of car sharing/pooling
- Monitoring and Prediction of energy consumption
- Stimulating: Bike sharing, e-bikes, car charge, etc.
- Sizing energy plants



- · Reduction of emission, reduction of congestion
- Smart City infrastructure: monitoring and resilience, long terms predictions
- Effective and Low cost smart solutions
- What-if analysis, Simulations
- Origin Destination matrices computation





Reduction of emission, reduction of congestion Monitoring and Predicting: NO2, NOX, CO2, Traffic flow, pollutant, landslide, waste, etc.

Traffic flow reconstruction

Demand vs Offer of Mobility analysis



- Predictive maintenance
- Decisions Support Systems
- Process optimization, control
- Industry 4.0 integrated solutions



- **Optimization of Waste Collection**
- business intelligence tools for decision makers
- Reduction production costs
- Monitoring resource consumption



- Shortening justice time
- Prediction of mediation proneness
- Assisting institution is taking legal decisions
- Anonymization and indexing legal docs.
- Ethical Explainable Artificial Intelligence

Snap4City (C), June 2025 (10/2024)







Smart City Control Room Florence Metropolitan City









- Thousands of Open/Private data, POI, IOT, etc.
- mobility and transport: accidents, public transport, parking, traffic flow, Traffic Reconstruction, KPI, ...
- **AND**: environment, civil protection, gov KPI, covid-19, social & social media, people flow, tourism, energy, culture, ...

Multiple dash/tool Levels & Decision Makers

• Real Time monitoring, Alerting, quality assess.

Predictions, KPI, DSS, what-if analysis

Historical and Real Time data

Billions of Data

Services Exploited on:

Multiple Levels, Mobile Apps, API

Since 2017





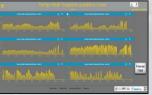




























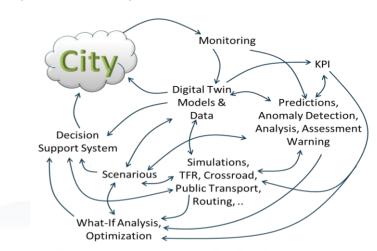




• Goals:

Assets Control Domain (2024/8)

- Costs reduction, increase service availability, risk reduction
- Quality Level
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring:
 - Assets: switches, Wi-Fi, servers, UPS, sensors, building, TV Cams, etc.
 - Energy: consumption, operative conditions, UPS continuity, etc.
 - **Production**: continuous serviceability analysis
 - Ftc.
 - Early detection/warning, alarm, of critical conditions
 - **Multichannel** Event reporting, notifications: email, Telegram, mobile apps, SMS, etc.
 - Managing maintenance operation, predictive maintenance
 - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
 - Reduction maintenance costs, reduction of critical SLA conditions, improve service level
- Algorithms and computational solutions, see next slide

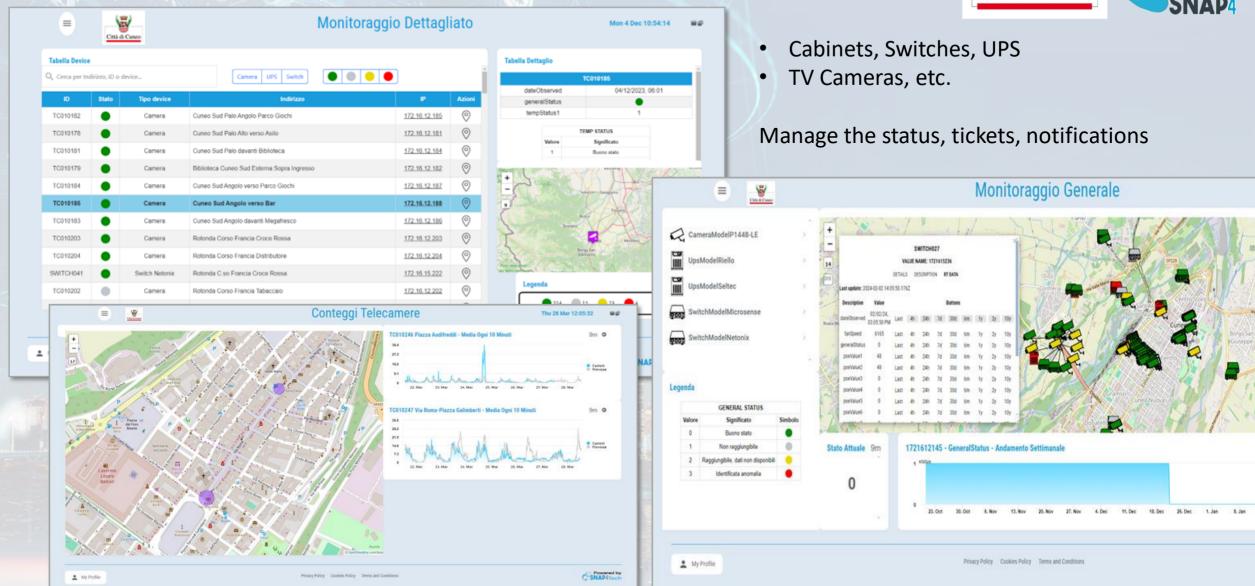




ICT Assets Control: CUNEO Municipality







Snap4City (C), June 2025

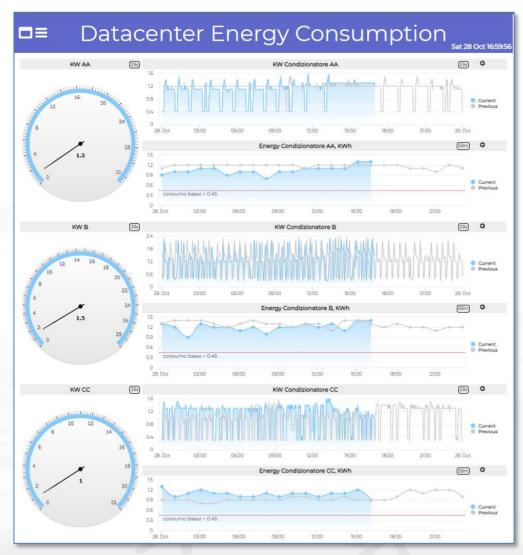


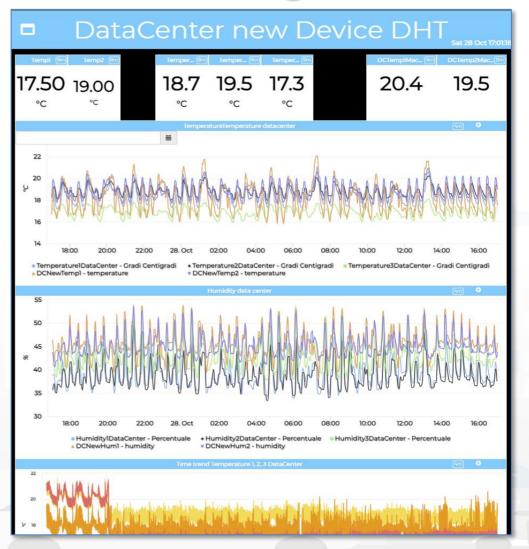






Data Center monitoring







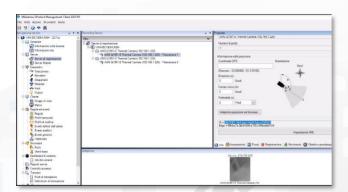


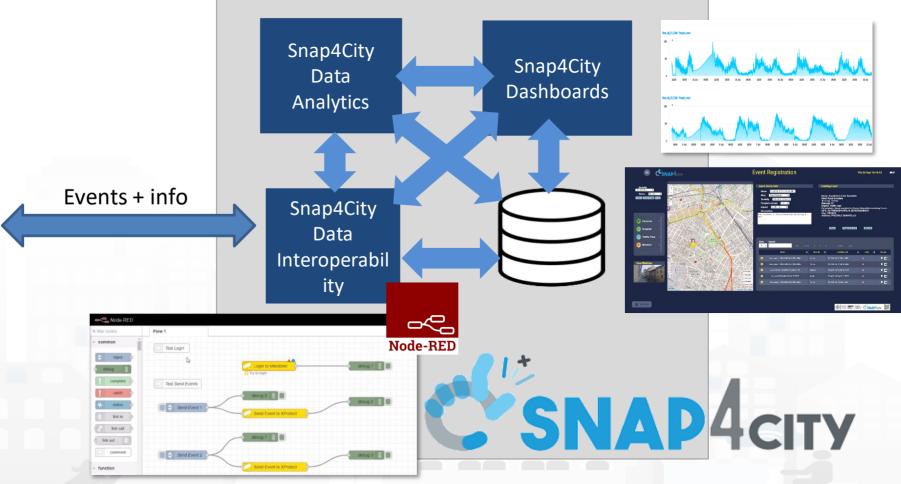




VMS vs Snap4City: sending and getting events, AI solutions







Enging via Mobile

IOT APPLICATIONS

SNAP4CH Y ARCHITECTU... AND ECOSYSTEM. OPENED TO DEVELOPERS AND STAKEHOLDERS

VIGILANCE: SOCIAL
MEDIA-ANALYSIS

TWITTER

SNAP4CITY AND KM4CITY PROJECTS

 SNAP4CITY THE VIEW OF THE ADMINISTRATORS

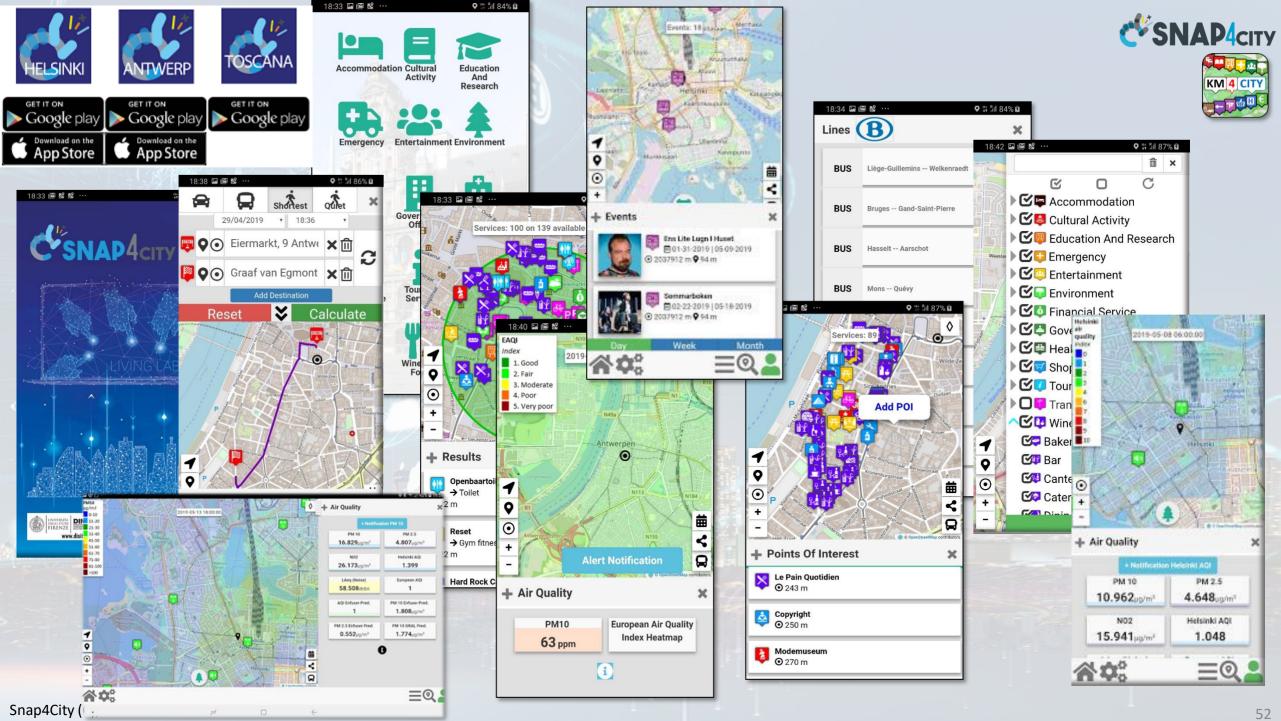
FROM CITY DASHBOARD TO APPLICATIONS

> DATA AND KNO MAN

VS IOT EDGE DEVICES TO ADOPT 4CITY, AND ROADMAP Dat mnd repoty armact on Chitcy Smart endoction Reporting issuse while ovstly Clinwing 台 Snaat cicret







Citizen Engagement/Participation via Mobile Apps





- GPS Positions
- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images
- Subscriptions to not fications
- ...

Produced information

- Viewed?
- Accepted?
- Performed?

•



Snap4City (C), June 2025



Derived information

- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- Cumulated Scores from Actions
- Requested information
- Routing performed

.



Produced information

- Suggestions
- Engagements
- Notifications

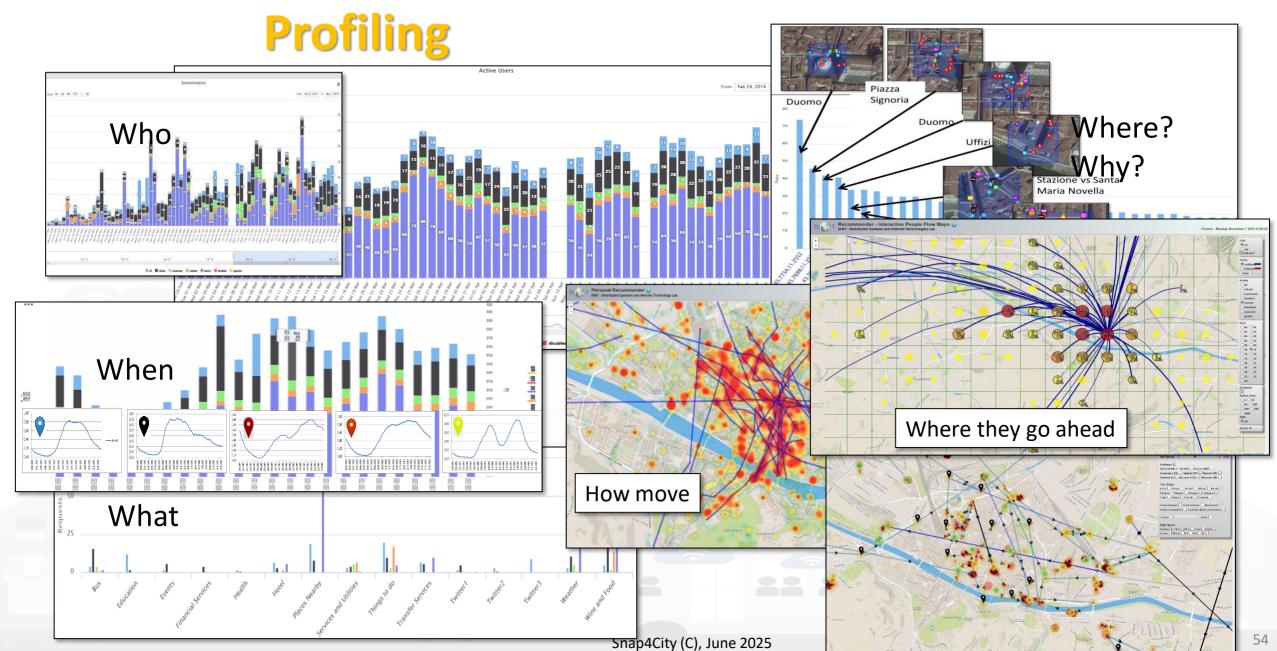
System





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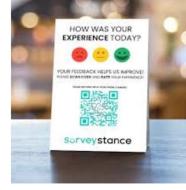
QR Engagement SNAP4city



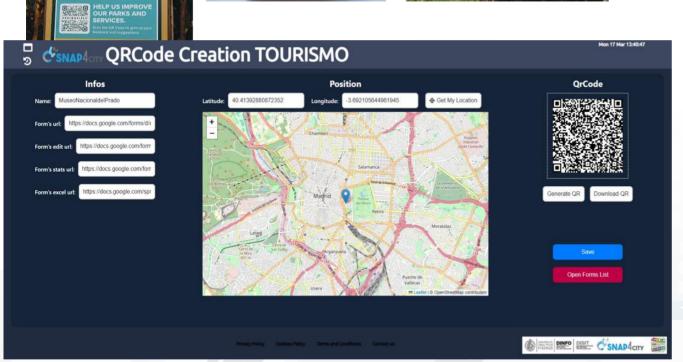


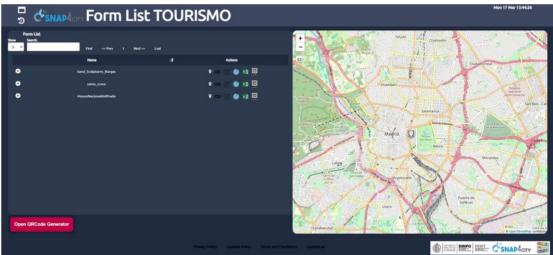


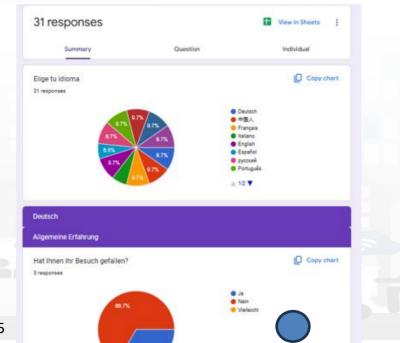
SUNSET ROCK



















Participation and Engagement

City users: residents, students, commuters, tourists, visitors, business visitors, etc.

Participation

- Collect complaints about city services
- Multichannel: mobile Apps, open call numbers, web pages and blogs, social media, help desk, info points, white boxes in the city, telegrams, SMS, etc.
- Data integration, usage of LLM, AI deep learning

Engagement

- Involving city users to perform actions: take photo, provide a suggestion a rank, etc.
- Commonalities: data collection, workflow management, operators, etc.

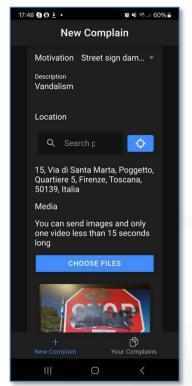






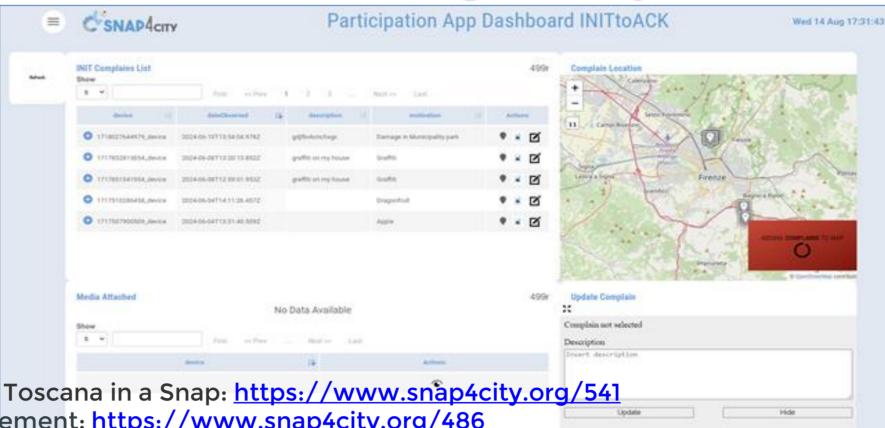


Operator Interface to manage complains









•mobile app Toscana in a Snap: https://www.snap4city.org/541

- User Engagement: https://www.snap4city.org/486
- •MultiPurpose user engagement: https://www.snap4city.org/548
- User Engagement admin: https://www.snap4city.org/472

https://www.snap4city.org/1018

Mobility and Transport

GOOGLESS

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Mobility & Transport

- Goals:
 - Decongestion, Decarbonization, costs reductions
 - Improve Accessibility to services
 - Improve Security/Safety of city users
- Operation and Plan:
 - Traffic monitoring, prediction, reconstruction, identification of critical conditions (early warning), fleet management, dynamic routing, multimodal routing, city user behaviour analysis
- Optimization and what-if analysis traffic light, infrastructure
 - Reduction: travel time, waiting time, stops, CO2 emissions, consume fuel, travel time for tramways
- Public Transport: analysis of Mobility Demand vs Offer of Transportation
- Parking Management: monitoring, prediction, any payments, on/off-road
- Sharing / Pooling Management: eShare and mobile app, bikesharing, smart bike, fleet management
- KPI: SUMI/SUMP, travel time, emissions, traffic status, accessibility, ...
- Mobile App: final users and operators
 - Info Mobility, traffic reconstruction, charging, participation,
 - Parking, payments, overparking, fine reporting, ...
- Participatory: problem reporting, ticketing, etc.
- Data Integration of any kind: env, weather. Tickets, presences, POI, sat, etc.









Il Futuro della Mobilità Intelligente Sostenibile as a Service

26 giugno 2025

Università degli Studi di Firenze – Scuola di Ingegneria | Via Santa Marta 3, Firenze

OPTIFaaS

AI-Powered Digital Twin Platform for Mobility & Transport Operation and Plan







FREE TRIAL



















EXPERT SYSTEM, KNOWLEDGE BASE

SEMANTIC REASONING

SMART DATA MODEL

IOT DEVICE MODELS, STORAGE

Digital Twin Solutions for Sustainability

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS







DEVELOMENT ENVIRONMENT

VISUAL PROGRAMMING, ML, AI, HPC

AND METHODOLOGY

• TRAINING COURSES

. LIVING LARS











DATA FLOWS, WORKFLOWS PARALLEL DISTRIBUTED PROCESSING **DATA DRIVEN**











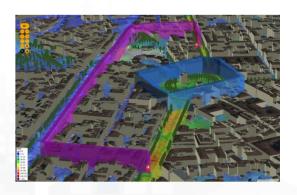




Mobility and Transport Domain (2024/8)

- Goals:
 - Decongestion
 - Decarbonization
 - Accessibility to services
 - Security/Safety of city users
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring traffic, parking, people flow, services, boats, ports, beaches, etc.
 - Early detection/warning of critical conditions: traffic, congestion, security/safety
 - Managing Smart Parking, transportation services, fines, etc.
 - Managing fleets: personal, sharing, waste collection, maintenance, etc.
 - Managing E-sharing, pooling services, MaaS, etc.
 - Managing entrances in city areas: restricted areas, touristic busses, etc.
 - Production of suggestions, recommendations, nudging
 - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
 - Reduction of traffic congestion, via optimization: traffic light plans, viability, routing
 - Reduction of Pollutant Emissions, via optimization: traffic light plans, viability
 - Optimization of transportation offers wrt multimodal mobility demand
- Algorithms and computational solutions, see next slide









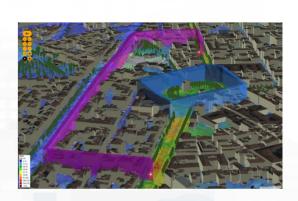




Tools for Mobility and Transport (2024/8)

- Optimisation of viability of an area for reducing congestion, waiting time, stops
- Optimisation of Traffic Light Plans, synchronization, in an area for reducing congestion, waiting time, stops
- **Predictions** for: traffic flow, smart parking, smart bike sharing, people flows, etc. (ML, DL)
- What if analysis: routing, traffic flow, demand vs offer, pollutant, etc. (Simulation + ML)
- Traffic flow reconstruction from sensors and other sources (simulation + ML)
- Public Transportation: Ingestion and modelling of GTFS. Transmodel. NeTEx. etc. (DP)
 - Analysis of the demand mobility vs offer transport of according to public transportation and multiple data sources (Simulation)
 - Assessing quality of public transportation (analysis)
- Accidents heatmaps, anomaly detection (analysis, ML)
- Road light controlled by traffic conditions
- Tracking fleets, people, via devices: OBU, OBD2, mobile apps, etc. (DP)
- Routing and multimodal routing (multistop travel planning), constrained routing, dynamic routing (DA)
- Computing Origin Destination Matrices from different kind of data (analysis, DP, DP)
- Computing typical trajectories on the basis of tracks (analysis, ML)
- Fleet management, monitoring, booking, allocation, maintenance
- Computing Messages for Connected drive (DP)
- Slow and Fast Mobility 15 Minute City Indexes (analysis, DP, ...ML)
- Computing and comparing traffic flow on devices and at the city border (analysis)
- Typical time trends for traffic flow and IoT Time series. (analysis, ML)
- Impact of COVID-19 on mobility and transport
- Computing SUMI, PUMS, etc. (mainly DP)
- **Definition of Scenarios:** traffic, road graph, conditions, etc.
- Etc.







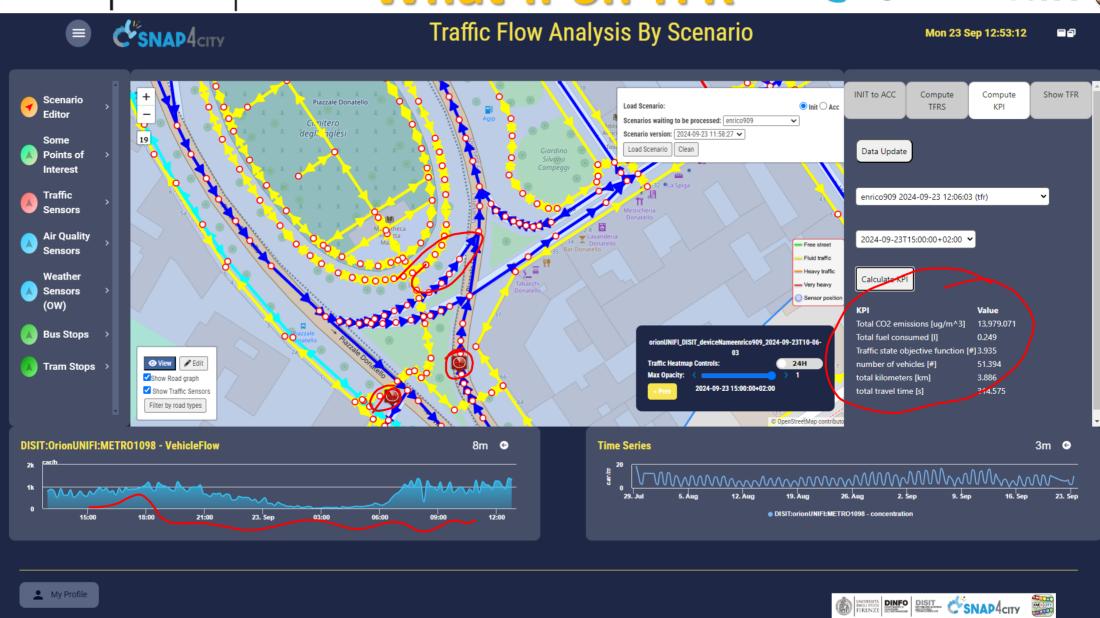
università degli studi FIRENZE



DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

What-if on TFR







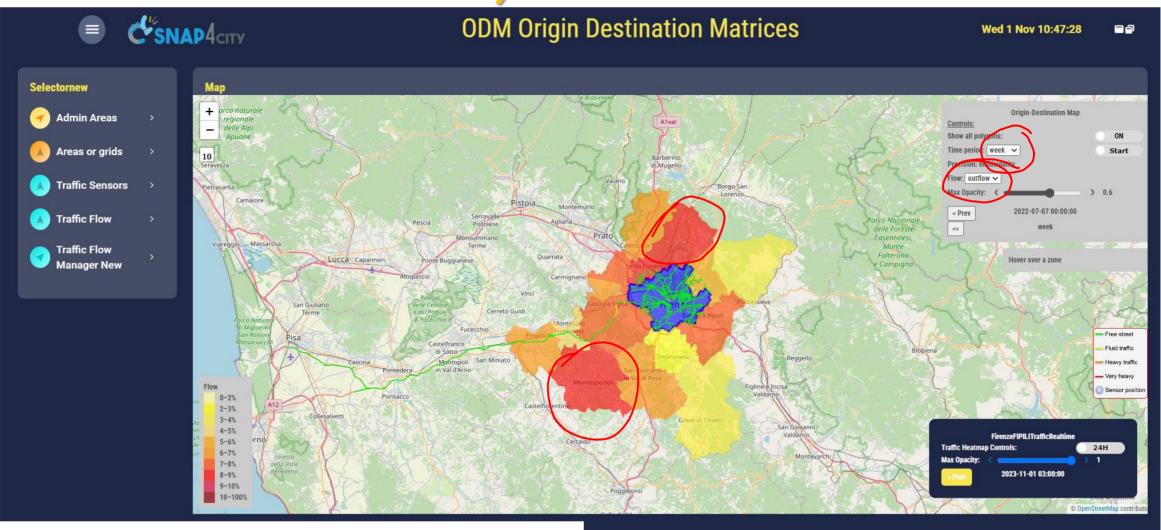








ODM, Traffic Flow



https://www.snap4city.org/dashboardSmartCity/view/Gea-Night.php?iddasboard=Mzk3Nw==



















Traffic Flow Tools

Spire and Virtual Spires (cameras), Bluetooth, ...
Specifically located: along, around, on gates, on x...



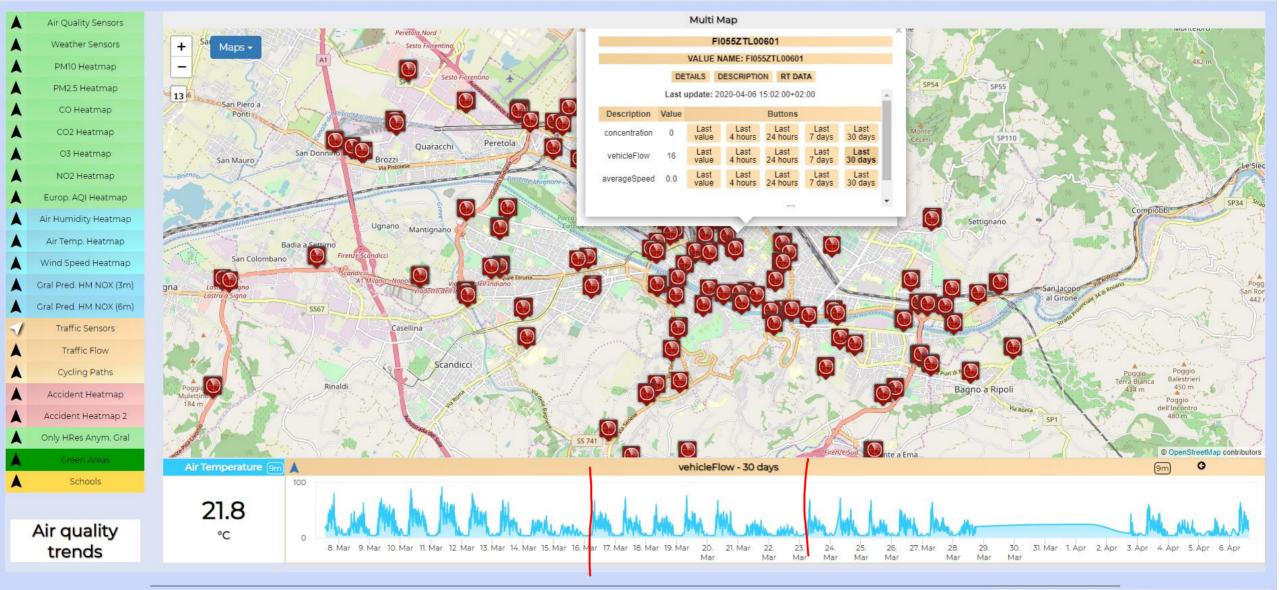


Firenze - Trafair - AirQuality Heatmaps

This dashboad contains data derived from actual sensors and predictive values under validation



Mon 6 Apr 15:12:27



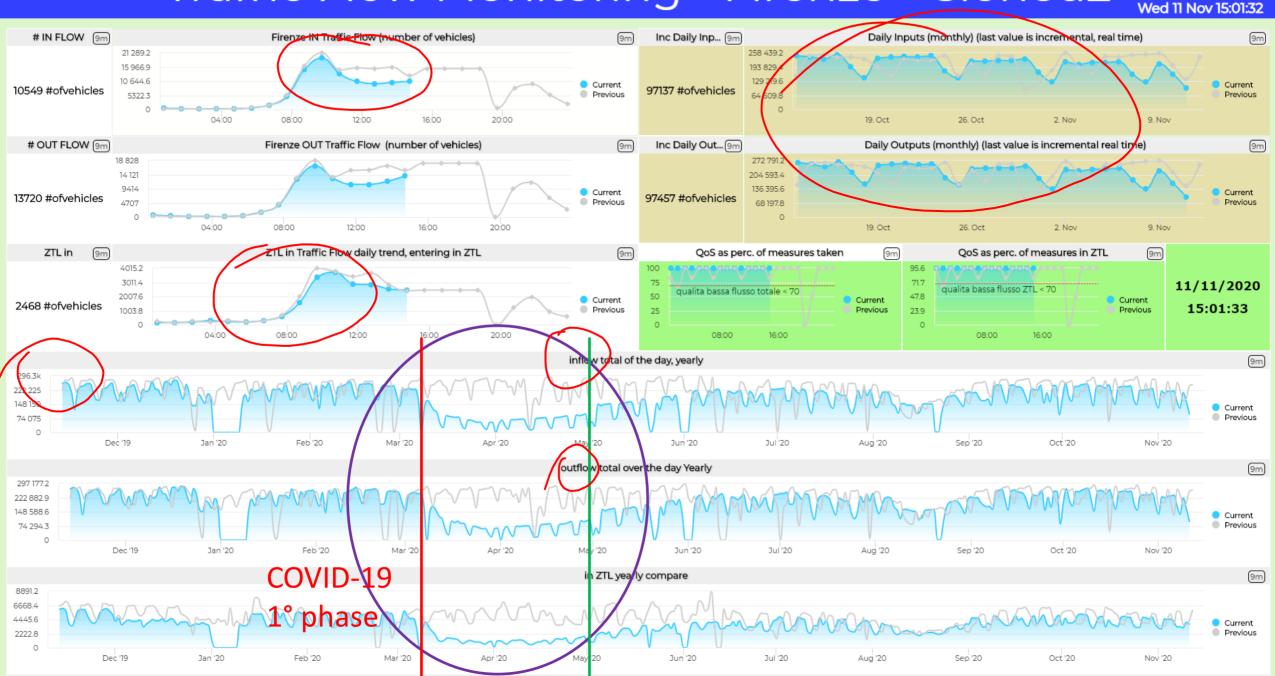








Traffic Flow Monitoring - Firenze - Cloned2





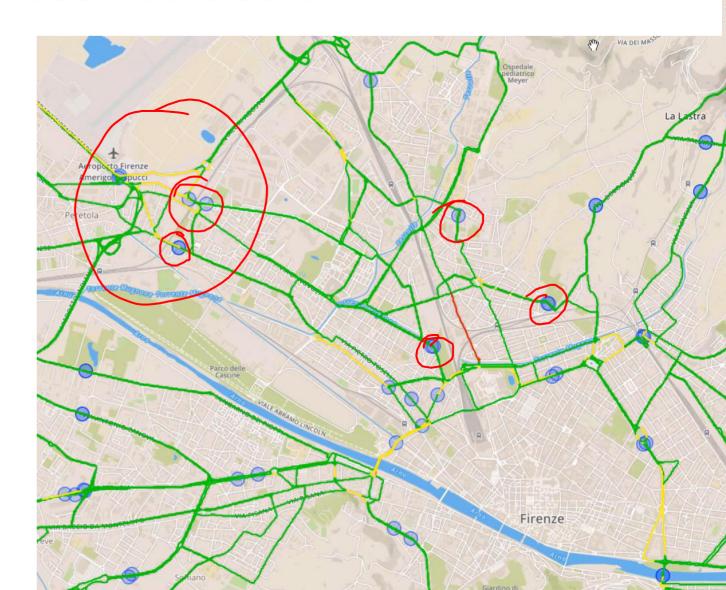






Dense Traffic Flow Reconstruction?

- Making decision on mobility and transport solutions \rightarrow what if analysis
- Controlling pollution
- Dynamic Routing for Firebrigade, Ambulances, general public
- Planning Public Transportation routing



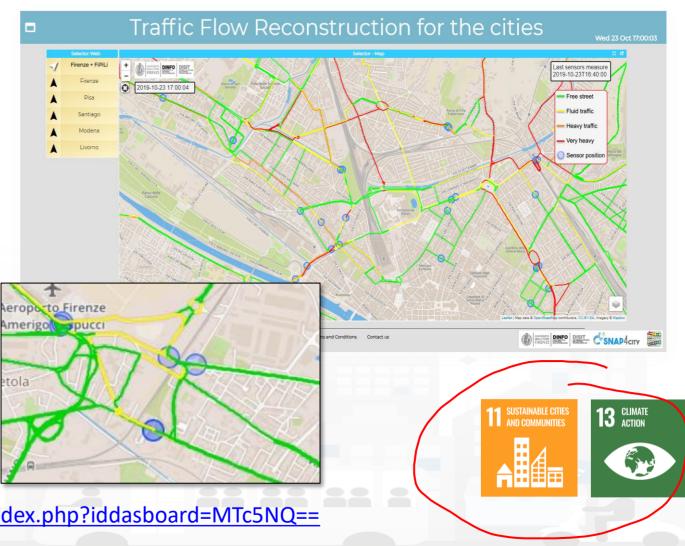






Why Dense Traffic Flow Reconstruction?

- Making decision on mobility and transport solutions → what if analysis
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- Planning Public Transportation routing



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==





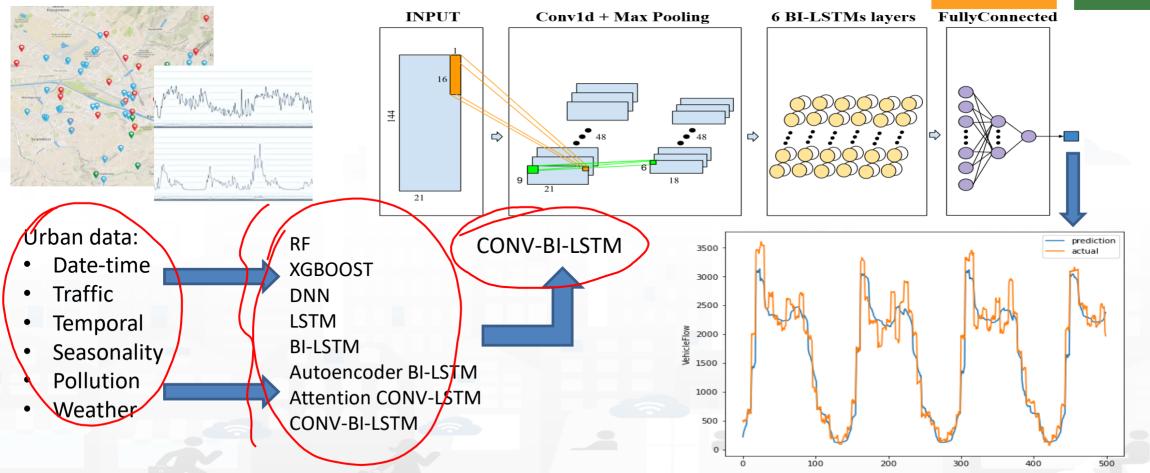




Short-Term Prediction of City Traffic Flow via Convolutional Deep Learning











What-If Analysis SNAP4city



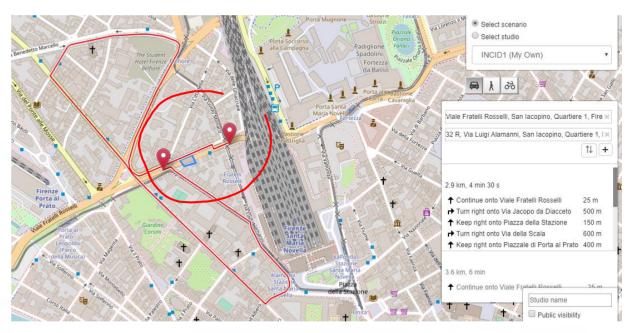


Accidents and elements blocking Points and Shapes taken into account for:

- Routing
- Traffic Flow reconstruction
- Evacuation paths
- Rescue team paths

Assessment on the basis of changes:

- Mobility demand assessment
- Mobility Offer assessment





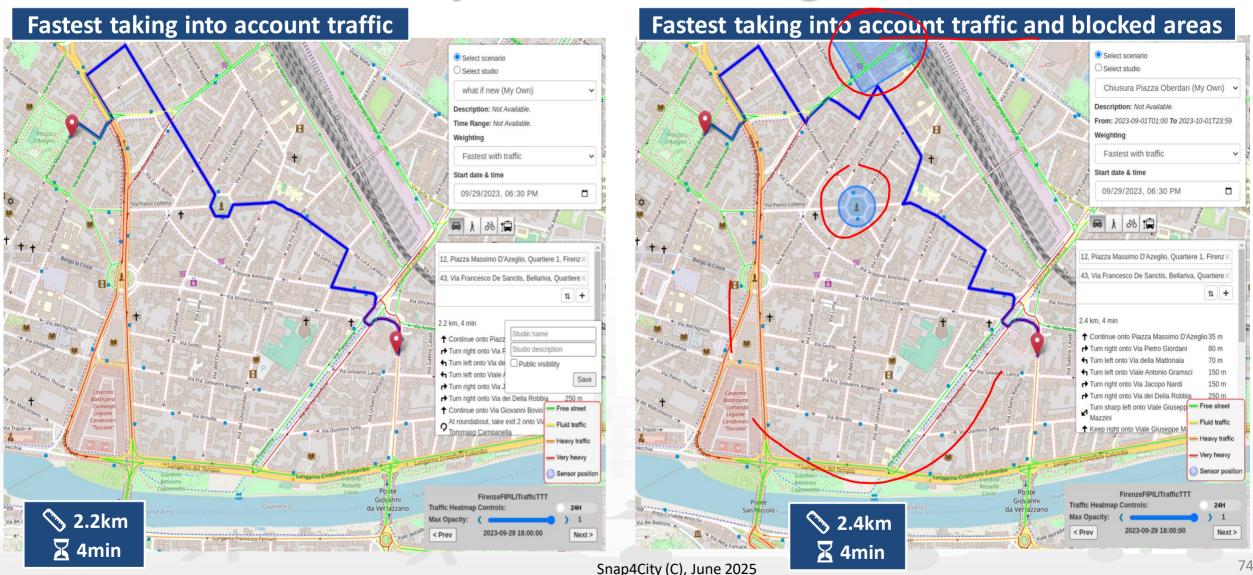








Constrained Dynamic Routing: Traffic Flow











Categ

Features

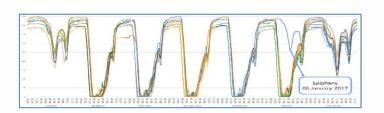
Parking predictions SNAP4INDUSTRY





I would arrive to surely Park in 45 Minutes??

Description of features variable



orv Real number of available slots recorded Free parking slots every 15 minutes Baseline features of free slot data Hours and minutes Time Month of the year (1-12) Month Day of the month (1-31) Day Day week Day of the week (0-6) Weekend 0 for working days, 1 else Previous Difference between the number of free spaces at time i and number of free observation's difference spaces at time (i - 15 minutes) recorded (POD) in the previous week Subsequent Difference between the number of free observation's spaces at time i, and the number of free spaces at time (i + 15 minutes) recorded difference (SOD) in the previous week City temperature measured one hour Temperature earlier than Time (°C) Weather features City humidity measured one hour earlier Humidity than Time (%) City rainfall measured one hour earlier Rainfall than Time (mm) Average speed of vehicles on the road Average being closest to the parking, over oneraffic Sensors Vehicle Speed hour period (km/h) Number of vehicles passing by closest to Vehicle Flow the parking, over one-hour period Average Average of distance between vehicles, Vehicle Time over one-hour period Vehicle Number of vehicles per kilometer, over one-hour period

SASSING THE INTERNATIONAL PRINCESSOR Concentration 13 CLIMATE ACTION

Artificial Intelligence Predictions

97% of precision







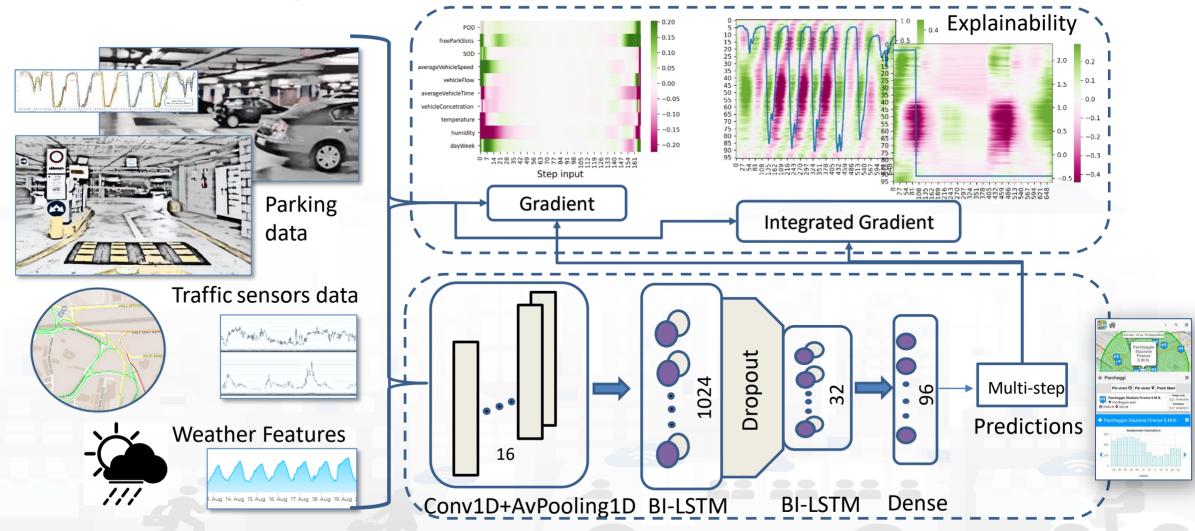








Deep Learning AI to surely Park!











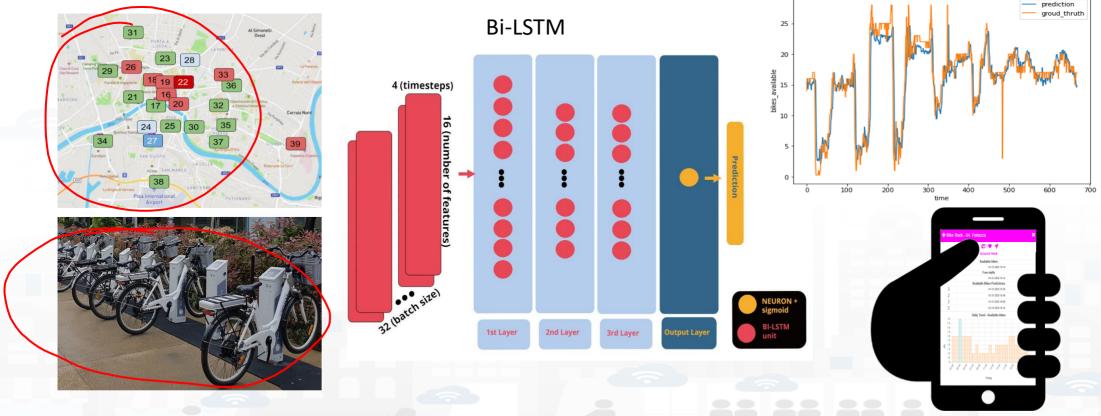


Deep Learning for Short-Term Prediction of Available Bikes on Bike-Sharing Stations



60 minutes Cluster 1 Bi-I STM





E. Collini, P. Nesi and G. Pantaleo, "Deep Learning for Short-Term Prediction of Available Bikes on Bike-Sharing Stations," in IEEE Access, vol. 9, pp. 124337-124347, 2021, doi: 10.1109/ACCESS.2021.3110794.







Road Parking

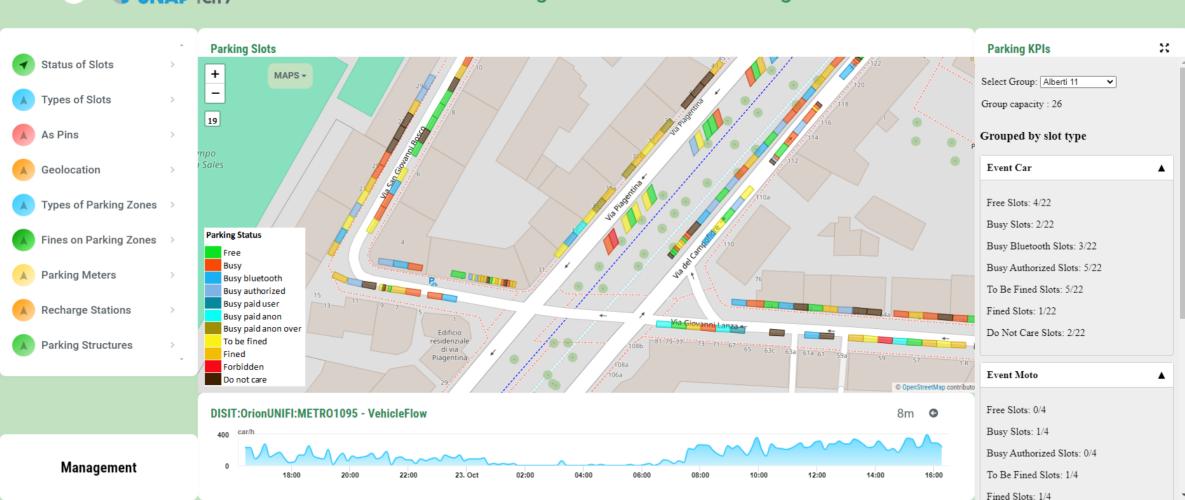




Parking Conditions Monitoring

Wed 23 Oct 16:24:41















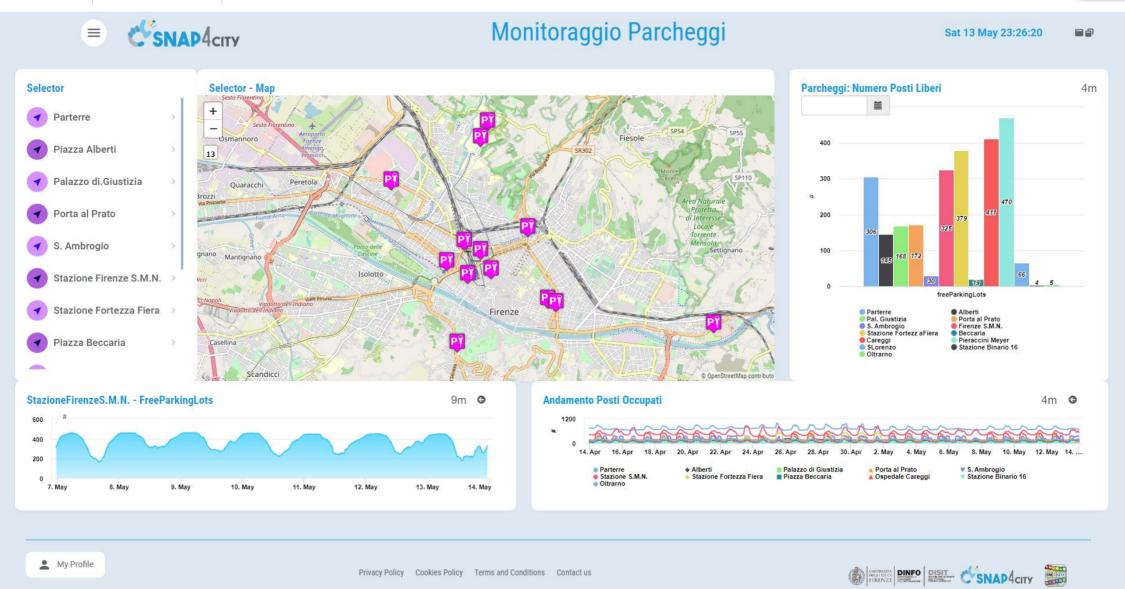












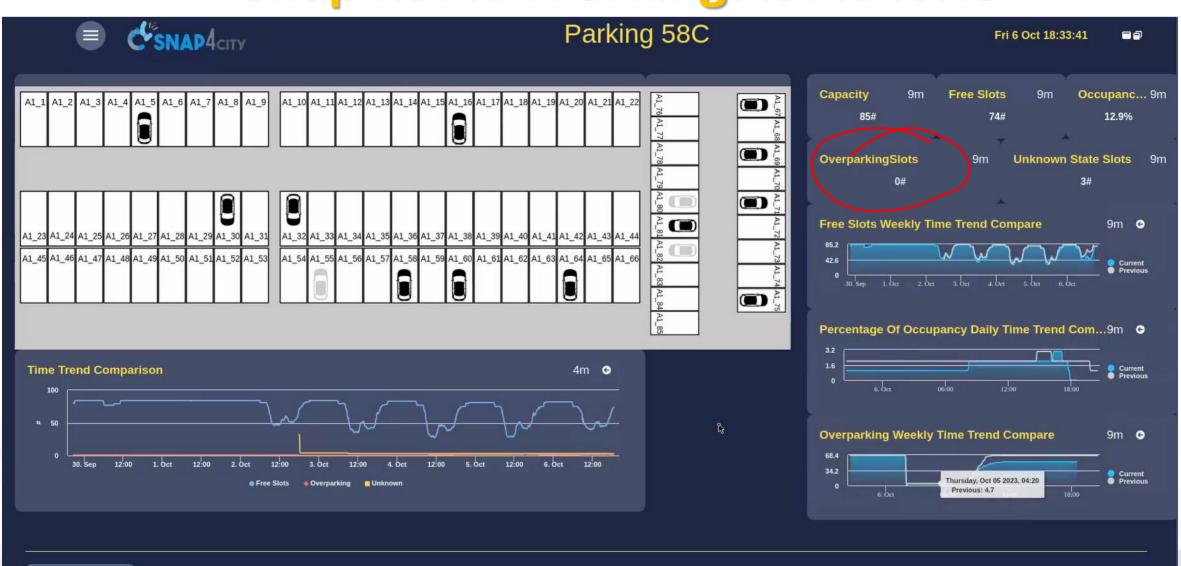








Snap4ISPRA Parking: ISPRA JRC











Decision Support Systems, What-if

Snap4City (C), June 202

Event planning, via what-if analysis

- Change in the graph structure of the city
- Impact on the flow of people and vehicles
- Adaptation: public transport, traffic, pedestrian management, etc.

Immediate reaction to natural events or not

- Everything is ready and updated in real time
- Each view is contextualized in terms of data: descriptive and prescriptive

Digital Twin

- More detail in the context integrated data
- Greater realism in deductions and representations
- Less fragmentation and non-uniformity in the views to support decisions













Mobility Demand vs Transportation Offer



What-if Analysis on Pub Transport









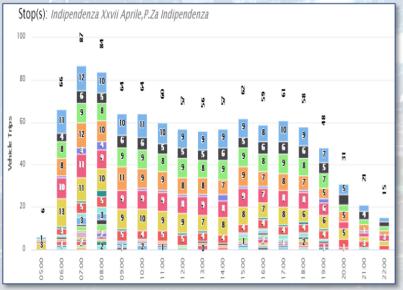
Simulation / analysis of Mobility Demand wrt Transportation Offer

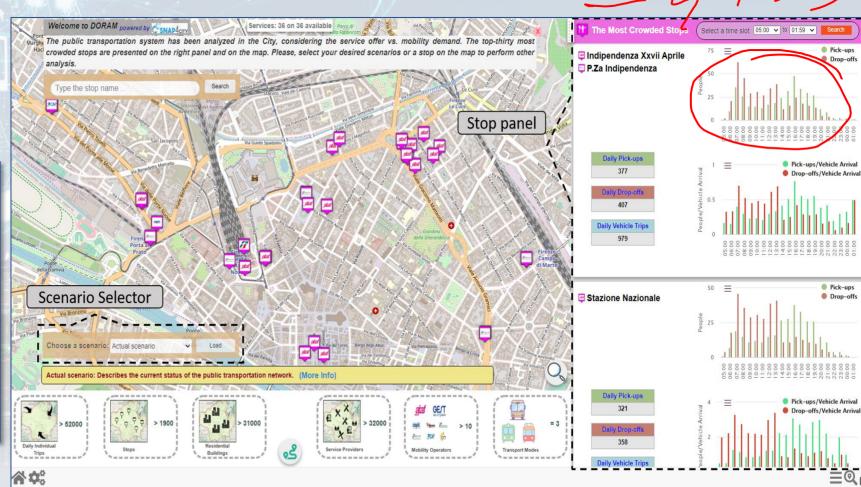
Definition of scenarious impact on

• Traffic, Pollutant, parking, public transport, private flows, etc.

KPI analysis

Public Services



















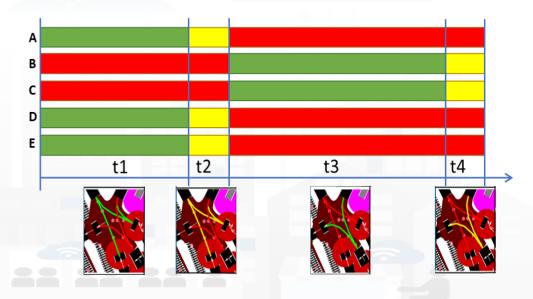




Traffic Light Plan Optimisation, Digital Twin

- Match Multiple Objectives and Synchronization:
 - public and private traffic, tramway priority
 - Micro and Macro Scales
 - AI: Genetic Algorithms, Reinforced Learning
 - Fixed and Actuated Cycles
 - Adjusted on Demand
- Validation/integ. with SUMO simulation
 - —— Travel Time, waiting time, waiting count
 - Specific travel time on directions
 - CO2 emissions, etc.
- Reductions from 5% to 15%



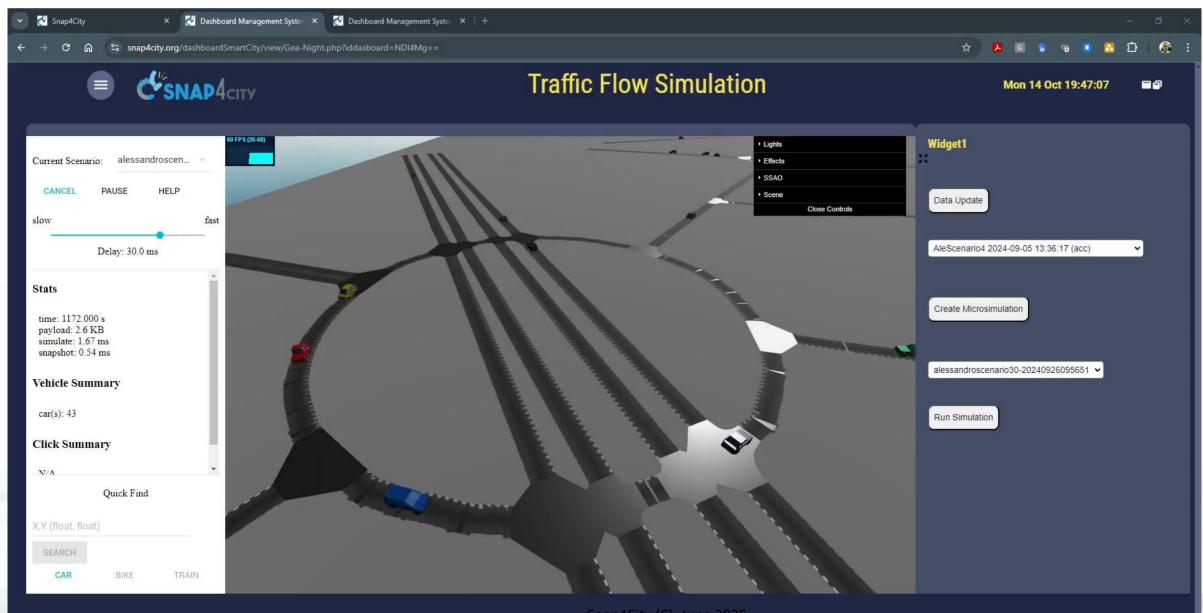




















Traffic Infrastructure Optimization









https://www.snap4city.org/1014









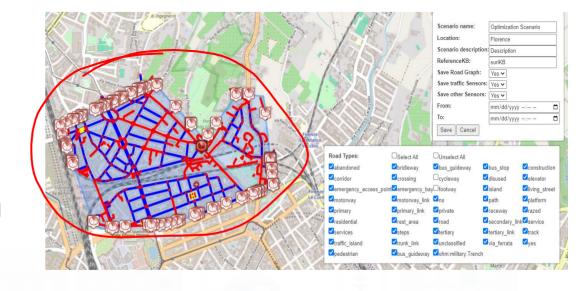






Traffic Infrastructure Optimisation, Digital Twin

- Identification of Scenario
 (Scenario Editor), any changes
 - Definition of traffic loads by flows
- What-if or Automated Optimisation
- Automated Optimisation:
 - Stochastic Relaxation, Simulated Annealing, Traffic Flow Reconstruction
 - Multiple objectives targeting
 - Travel time, emissions, fuel consumption, traffic status
 - Limiting the number of changes





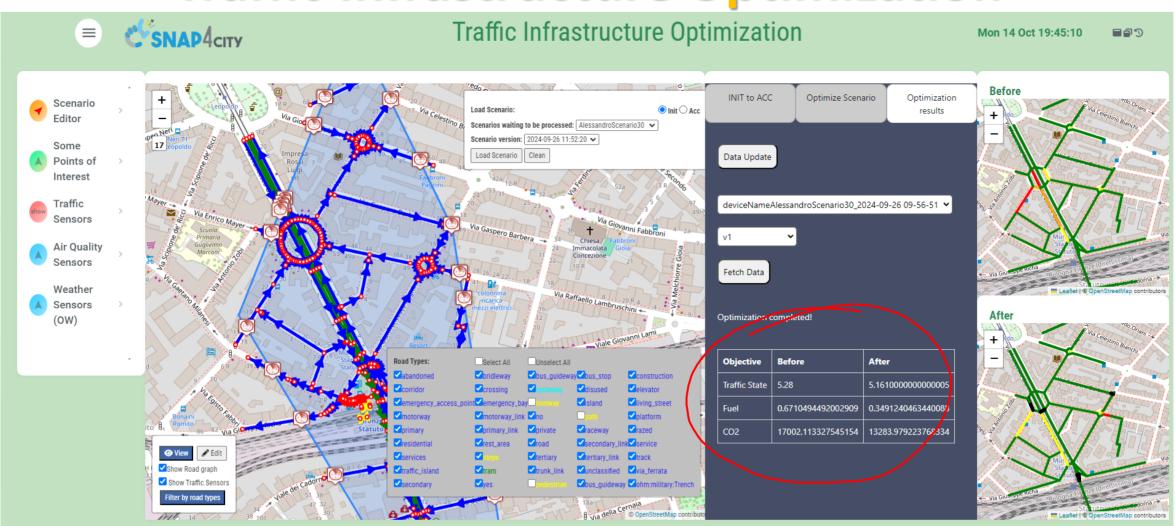








Traffic Infrastructure Optimization











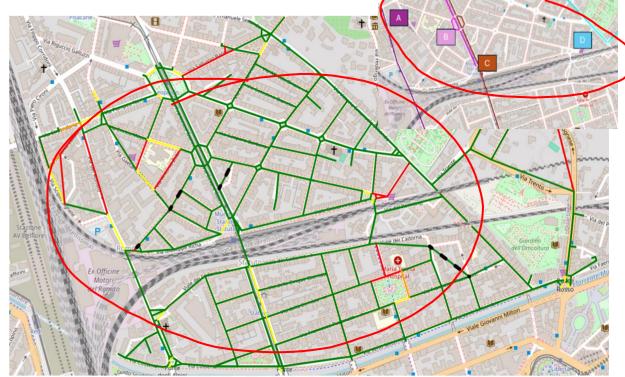




Optimization Results



Case max 4 changes	KPI estimation on the best solution					
Optimization Target	Traffic State	Fuel	CO2			
Optim 4 Traffic State	91.341- 21 %	17.964	128536			
Optim 5 Fuel	91.514	16.633 -35	% 128227			
Optim 6 CO2	92.859	19.192	127876 - 23			
Original	115.475	25.680	165822			



Travel Time [s]	Path A	Path B	Path C	Path D	Total Time
Original Scenario	183.2	59.6	80.9	132.5	456.4
Optim 4 Traffic State	93.2	60.0	63.7	96.0	313.1
Optim 5 Fuel	89.6	51.2	59.7	96.4	296.9
Optim 6 CO2	89.5	53.2	58.4	100.1	301.3





DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB





eShare in a Snap, by Snap4

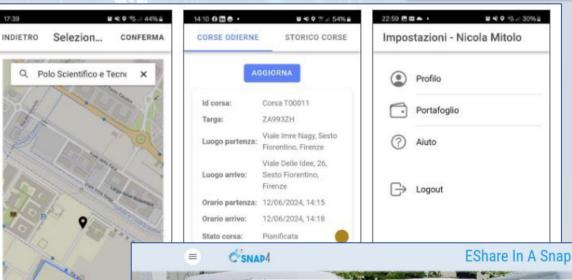


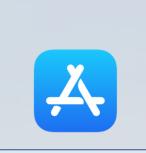
















Integrated car sharing and pooling Multiple drivers on the same means Dynamic pooling and e-sharing

Snap4City (C), June 2025

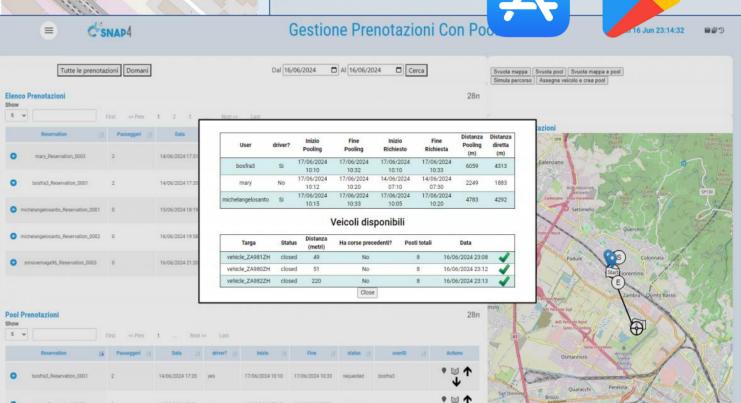
eShare in a Snap, by Snap4











Integrated car sharing and pooling
Multiple drivers on the same means
Dynamic pooling and e-sharing

Time Trend Batteria









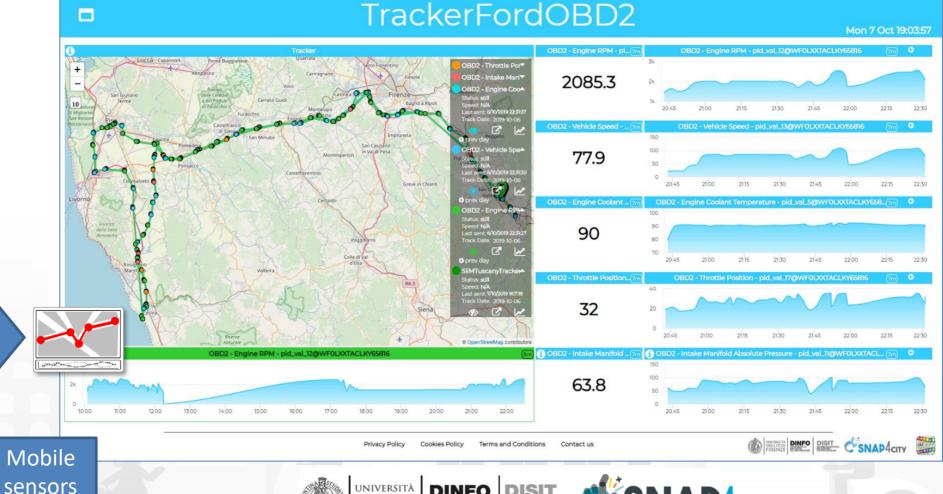


MyKPI: Tracking of Devices and Mobiles • Real Time Trajectories for

- - Mobile Phone
 - Moving IOT Devices
 - OBU, Vehicular Kits
 - Multiple tracks
 - Day by day

Micro Application























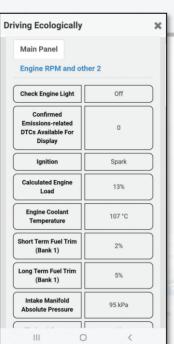
IOE — Vehicle Monitoring

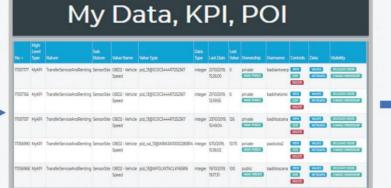


Tuscany in a **Snap Mobile** App on **Android**

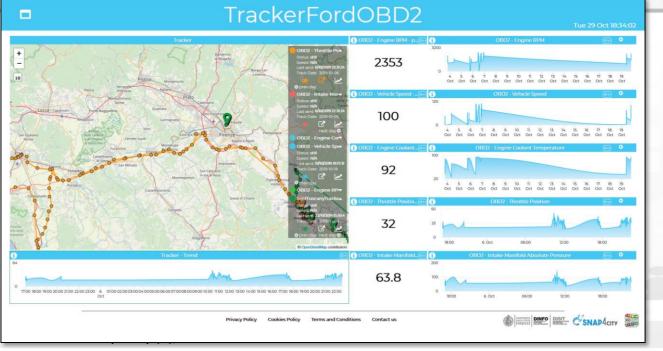
















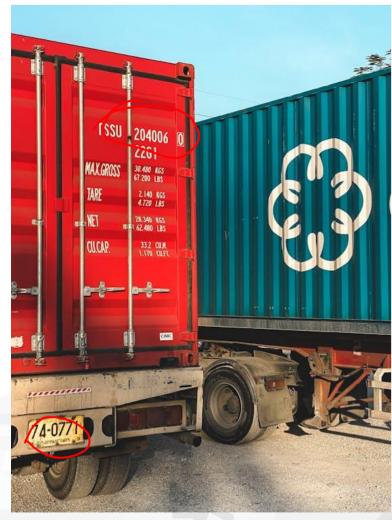








Trucks' Plates and Container ID Recognition



- **Managing Gates to Salerno Port**
- Gates: in/out
- **Recognition and decoding**
 - BIC code: TSSU 204006
 - ISO code: 22G1
 - Seal status: on/off
 - Multinational Plate: 74-0771



Details





FREE TRIAL



















Digital Twin Solutions for Sustainability

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS









ATA ANALYTICS, ARTIFICIAL INTELLIGENCE DATA FLOWS, WORKFLOWS
ABLE AI, MACHINE LEARNING, GENERATIVE AI PARALLEL DISTRIBUTED PROCESSING
OPERATIVE RESEARCH, STATISTICS DATA DRIVEN



- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES
- LIVING LABS
- GUI CUSTOM STYLES
- FULL APPLICATIONS, DASHBOARDS
 AND VIEWS
- MOBILE APPS



















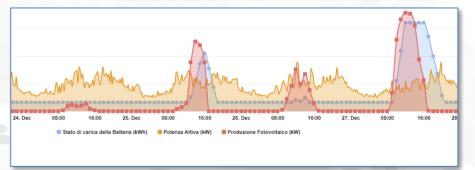
/ Energy and Buildings

- Energy consumption reduction, increment of efficiency,
- Areas and building sustainability
 - Improve accessibility to services, security and safety
- **Energy Monitoring:** Building, floors, rooms, recharging poles, cabinets, Community of Energy, Data centers, Energy for Hot / cold, air condition, energy vs temperature and usage, etc.
- **Energy Management:** Predictions, early warning, identification of critical conditions
- Smart Light Management: LED/mixt, cabinets, lights vs traffic, lights vs security, energy saving, luminaries profiling, group management.
- Smart Building Management: consumption, number of people, etc.
 - Communities of Energy, Photovoltaic plants, sustainability
 - What-if analysis, optimisation tools
- KPI: Energy consumption, efficiency, pros/cons
 - Light profiling and adaptation
 - Autoclave industrial plants simulation, Photovoltaic plant simulation
 - consumption / usage, energy vs temperature
- Mobile App: monitoring, info-recharge, eSharing, booking, ...
- Participatory: problem reporting, ticketing, etc.
- Integration of any kind













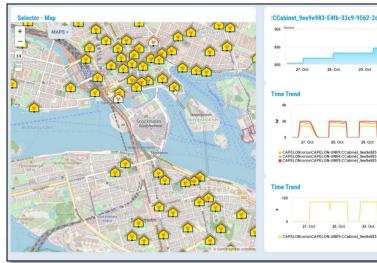


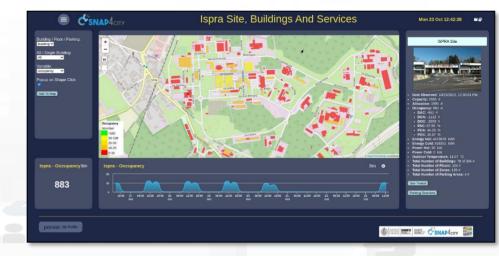




Goals:

- Energy Domain (2024/8)
- Energy consumption reduction, increment of efficiency, sustainability
- accessibility to services
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring energy consumption (heating, cooling, prod.,..), conditions, charging stations, etc.
 - Managing Smart Light for city: dimering, programming, traffic control, controllers, legacy, etc.
 - Early detection/warning, alarm, of critical conditions
 - Managing smart services: cabinets, lockers, etc.
 - Production of suggestions, nudging
 - Global and local 3D/2D representations of area and buildings
 - Managing Communities of Energy, certification via Blockchain
 - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
 - Reduction of energy costs, via optimization
 - Identification of roofs with better orientation
 - Optimization of battery storage size for PV plants
 - Community of Energy planning and viability
- Algorithms and computational solutions, see next slide











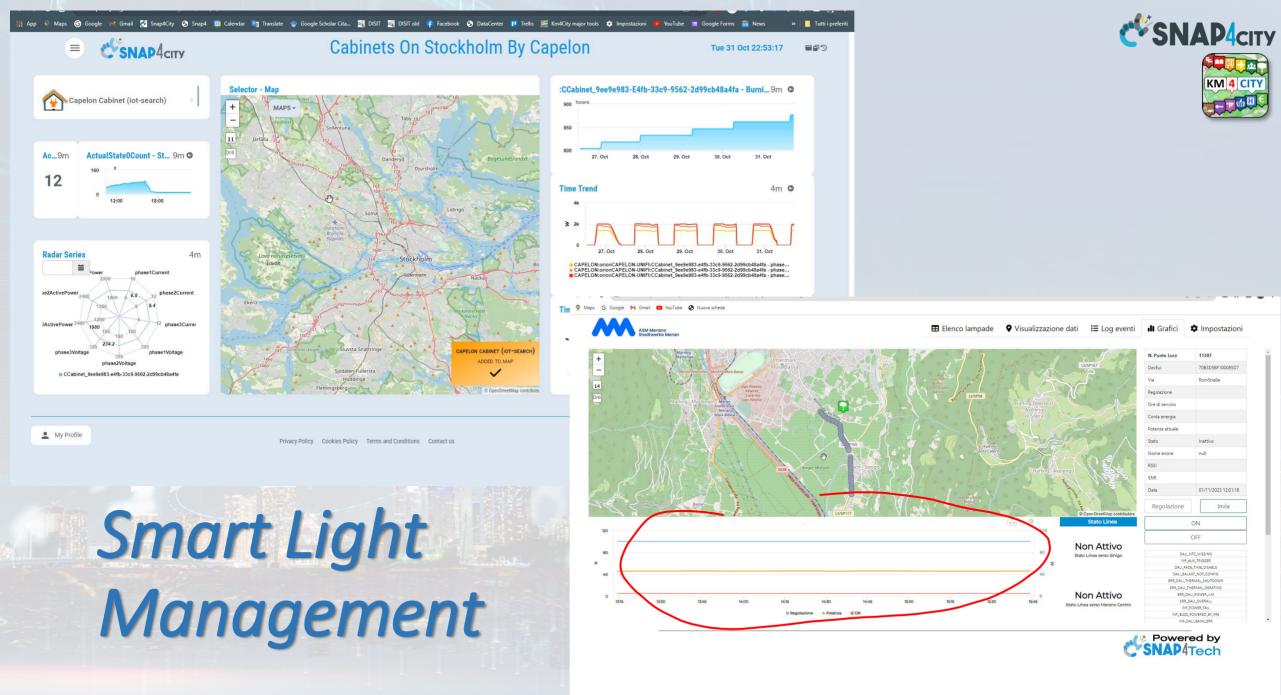


Tools: Energy Domain (2024/8)

- Monitoring Energy Consumption in single building, area and per zone
- Smart Light management, unicast and multi cast management, smart light controlled by traffic flow data
- Monitoring Energy provisioning on recharging station
- Matching Energy consumption with respect to the actual usage
- Computing Roof orientation for Photovoltaic installations
- Optimisation of Photovoltaicc installations to identify the best parameters of size and storage
- Collecting and managing Communities of Energy
- Computing KPI
- Etc.



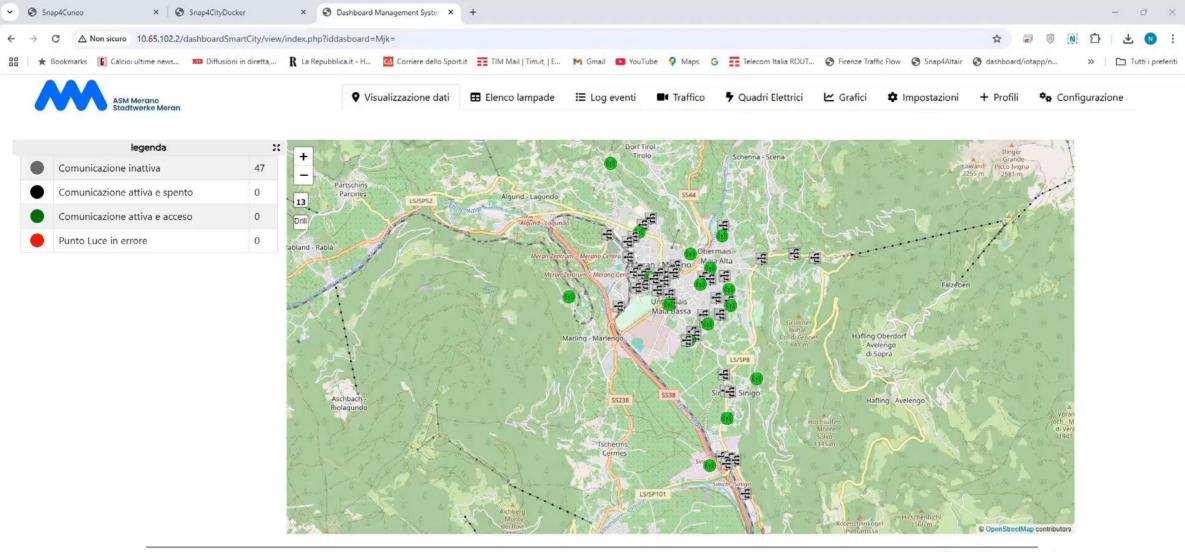




Snap4City (C), June 2025



KM 4 CITY





Snap4City (C), June 2025















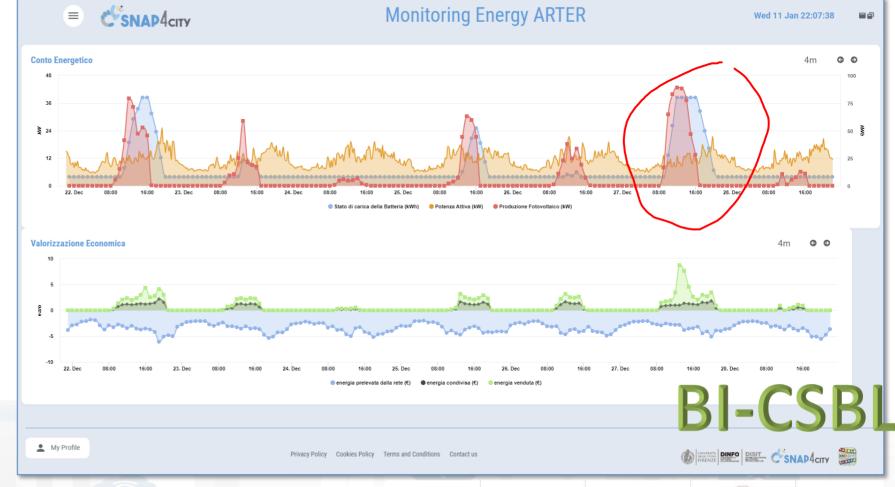
Field-tested energy community: the selfconsumer

condominium

The Self User project creates in the pilot condominium, through the collection and analysis of data, a model for calculating and enhancing the impact of an energy community on a community of people, with a view to actions to combat energy poverty

















enel x



▲ - PV + battery 10kWh

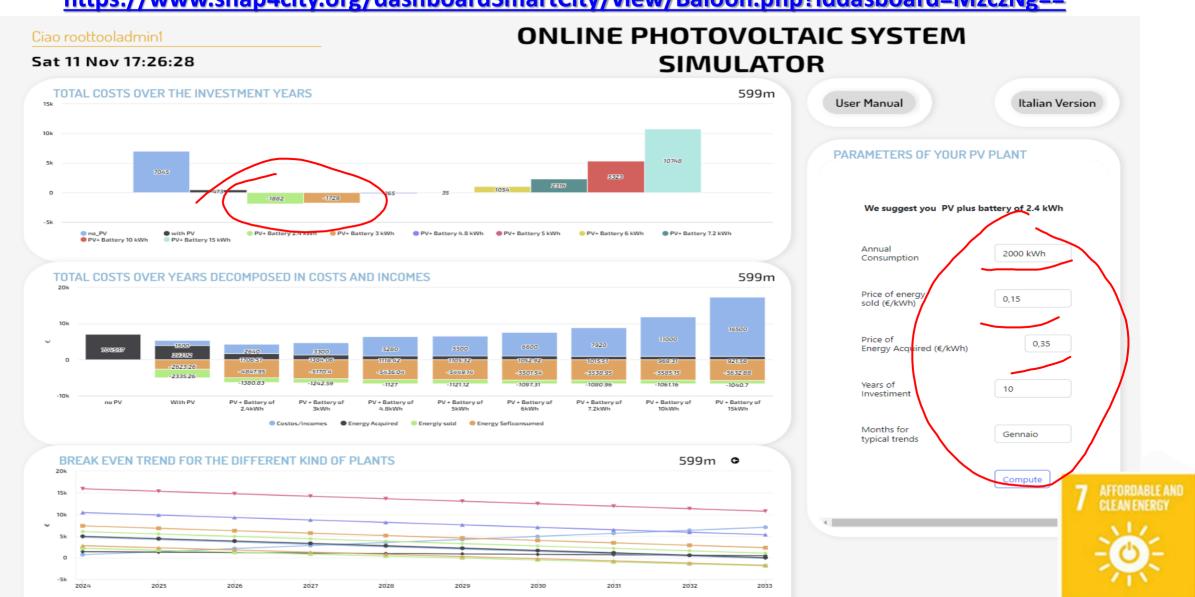
PV + battery 15kWh







https://www.snap4city.org/dashboardSmartCity/view/Baloon.php?iddasboard=MzczNg==



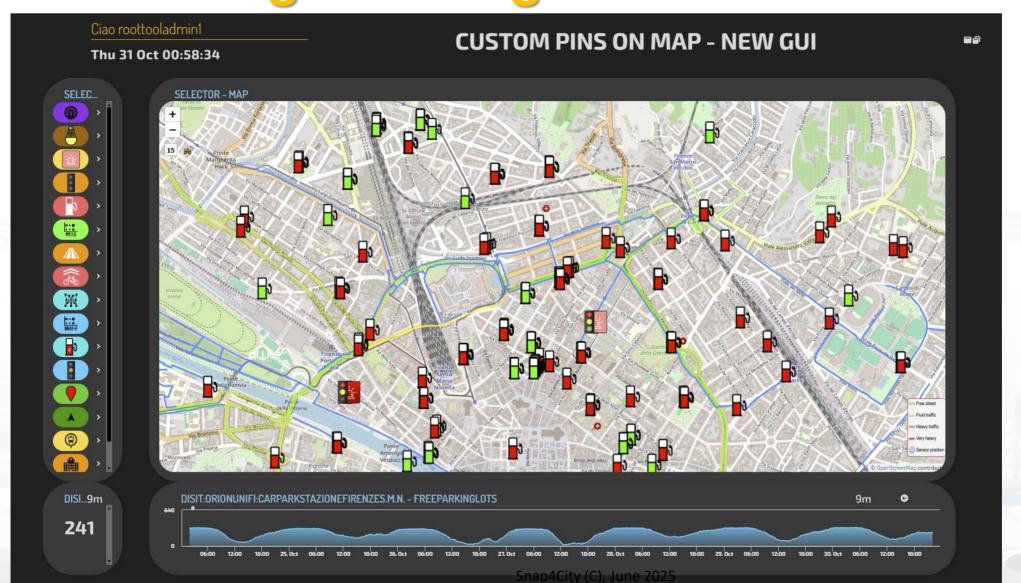






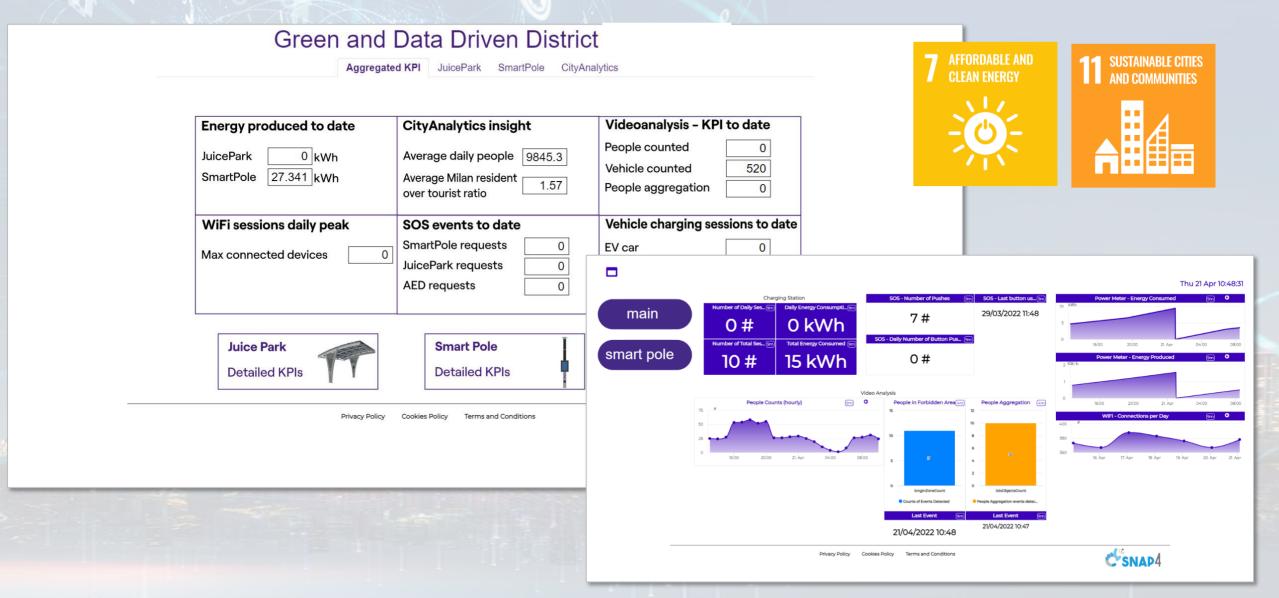


Monitoring recharing station and assets





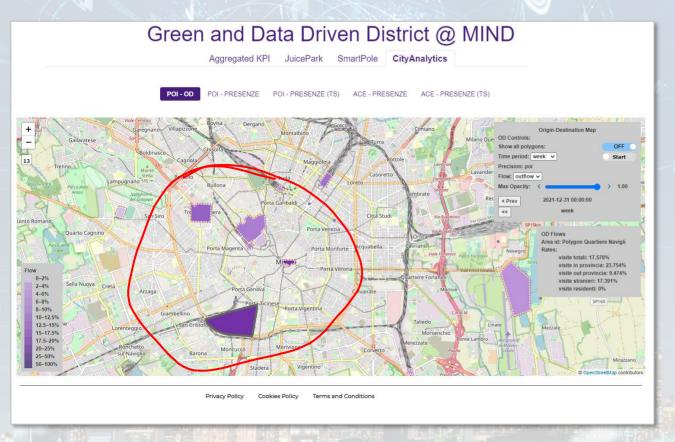
Energy monitoring and business intelligence



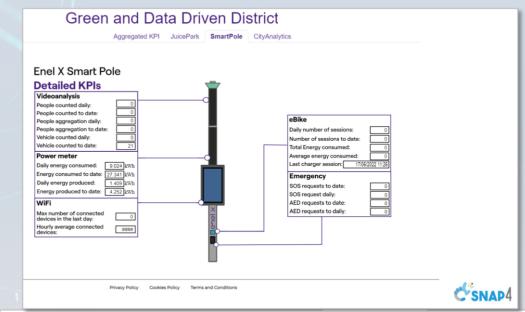
Snap4City (C), June 2025

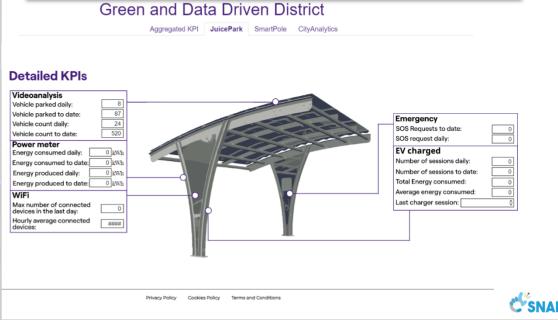
Energy monitoring and business intelligence



















Snap4Building Domain (2024/8)

- Goals:
 - increase efficiency, cost reduction, sustainability
 - Accessibility to services, Security/Safety
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring: usage, energy, environmental conditions, people flows, services, etc.
 - Early detection/warning, alarm, of critical conditions, notifications, decision support
 - Production of suggestions/prescriptions, nudging
 - Managing smart services: cabinets, dispenser, lockers, etc.
 - Global and local 3D/2D representations of area and buildings
 - Integration with Video Management Systems
 - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
 - Reduction of energy costs via optimization
- Algorithms and computational solutions, see next slide













Smart Buildings, Snap4Building (2024/8)

- Digital Twin for monitor, control and manage distributed infrastructures
 - 2D/3D representations of the whole set of buildings, BIM modeling
 - Entities (building, floors, rooms, parking, charging stations, gates, etc.) with their shapes and descriptors, and data monitoring the allocation to office, meeting, cafeteria, storage, stairs, elevator, etc.
- Monitoring and computing KPIs on real time for
 - energy consumed or produced (hot/cold), parking, logistic, presences, cleaning, air quality, departments, subareas, maintenance, etc.
 - allocation/designation, dispositions, heating, cooling, temperature, equipment, etc.
 - grouped in Zones





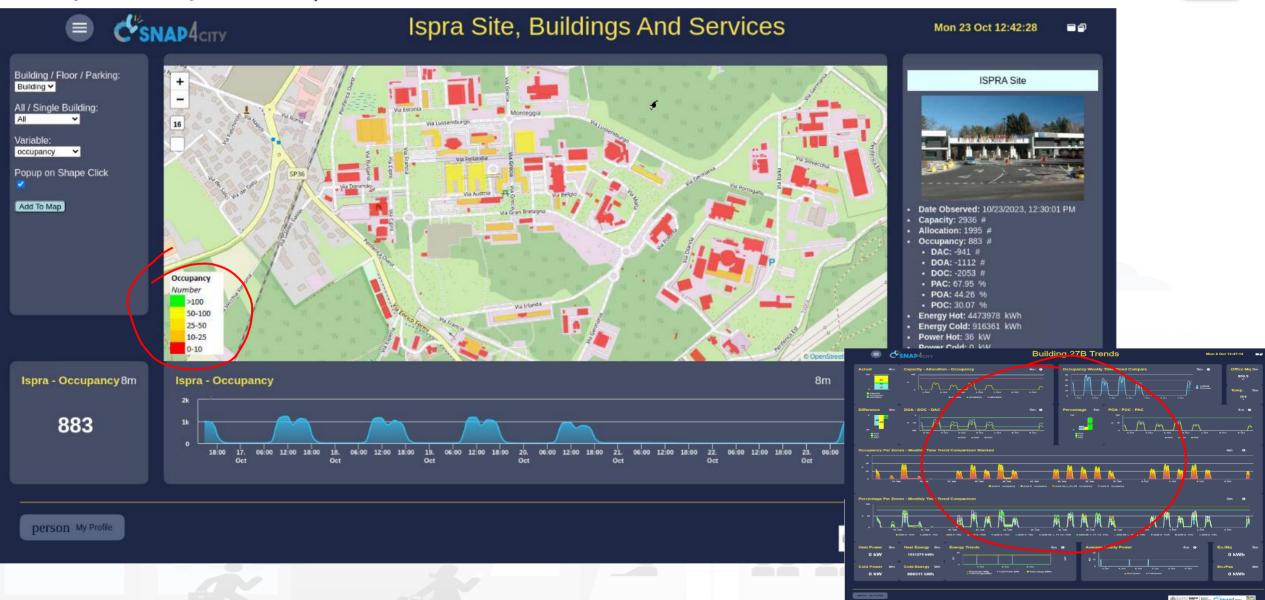






ISPRA JRC Site











Floor Details



ISPRA JRC Site

SNAP4CITY

Percentage Per Zones - Monthly Time Trend Comparisor

Occupancy Per Zones - Monthly Time Trend Comparison Stacked







DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB AND TECHNOLOGIES LAB









Details





FREE TRIAL



















Digital Twin Solutions for Sustainability

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS









VISUAL PROGRAMMING, ADAPTERS
DATA FLOWS, WORKFLOWS
PARALLEL DISTRIBUTED PROCESSING
DATA DRIVEN



- VISUAL PROGRAMMING, ML, AL, HPC
- TRAINING COURSES
- LIVING LABS
- GUI CUSTOM STYLES
- FULL APPLICATIONS, DASHBOARDS
 AND VIEWS
- · MOBILE APPS



















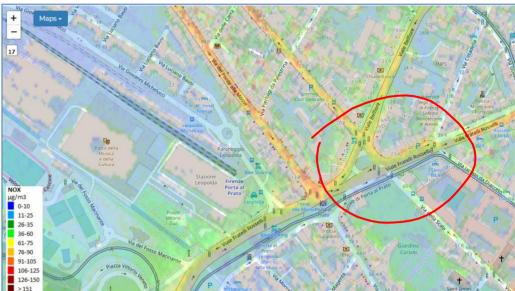
Environment and Waste

- Goals:
 - Reduction of emissions and EC taxations
 - Cost reduction for waste collection,
 - reduction of waste collection impact on mobility
- AIR quality (Indexes) monitoring and warning
- Environment Management & producing prescriptions:
 - Monitoring, long and short-term predictions, warning for:
 - GHG missions, pollutants, aerosol, chemical plants analysis
 - Traffic Flow impact emissions, predictions
 - Sea conditions, UV conditions, etc.
- Land slide prediction warning
- Coastal erosion monitoring and analysis
- Smart Waste Management and Optimisation:
 - costs reduction, optimal routing production, pay as you throw,
 - avoiding out of bins, predictions of waste production on bins, alarms

KPI: SDG, 15MinCityIndex, QOS, costs, Km, colleting time, EC KPI, emissions

Mobile App: final users services/informing and operators

- Info Waste for operators, participation, optimal routing, RAEE Collection, ...
- **Participatory**: problem reporting, ticketing, etc.
- Integration of any kind: env/weather, mobility, ticketing, presences, POI, ...













Environment, waste, land, etc., domain (2024/8)

- Goals:
 - Reduction of emissions and EC taxations
 - Cost Reduction for waste collection, reduction of waste collection impact on mobility
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring emissions, weather, waste, water, etc.: sensors, traffic, flows,
 - Early detection/warning of critical conditions on *emissions, weather, waste, water, fire, animals, ...*
 - Early detection/warning of critical conditions for landslides, water flooding, beach
 - Smart Waste Management: bins/lockers, waste collection daily plan, pay as you throw, PAYT, etc.
 - Short terms prediction of emissions: CO2, NO2, etc.
 - Production of suggestions, nudging
 - Computing and predicting of long terms KPI indicators of the European Commission
- Solutions for Planning (optimization and what-if analysis)
 - Identification of main CO2/NO2 emissions locations in the city, total production from traffic
 - Reduction of Pollutant Emissions, via optimization: semaphore cycles, viability
- Algorithms and computational solutions, see next slide







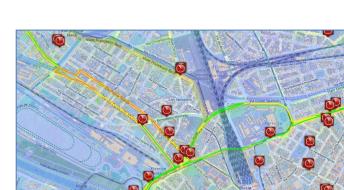






Tools: Environment, waste, land, (2024/8)

- Pollutant Predictions: short, long and very long term European Commission KPIs
 - NOX, PM10, PM2.5 pollution on the basis of traffic flow, 48 hours (ML, Al, DL)
 - Cumulated NO2 average over year (ML, AI, DL)
- Computation of CO2 on the basis of traffic flows (DP), computing emission factor (DA)
 - each road for each time slot of the day
- Prediction of MicroClimate conditions for diffusion (ML, AI)
 - NO2, PM10, PM2.5, etc.
- Prediction of landslides, 24 hours in advance (AI, DL)
- prediction of waste collection, & optimisation of schedule and paths (DP, ML)
- Heatmaps production dense data interpolation (DP) for
 - Weather conditions: temperature, humidity, wind, DEW
 - Pollutants and Aerosol: NO, NO2, CO2, PM10, PM2.5, etc.
- Impact of COVID-19 on Environmental aspects (DP)
- Computing SDG, SUMI, SUMP, .. (mainly DP)
- Etc.





Environment and Quality of Life

Air Quality Predictions

Multiple Domain Data

- Traffic Flow data, Pollutant: NOX, CO2, PM10, PM2.5, O3,
- 3D City structure, weather, ...

Multiple Decision Makers

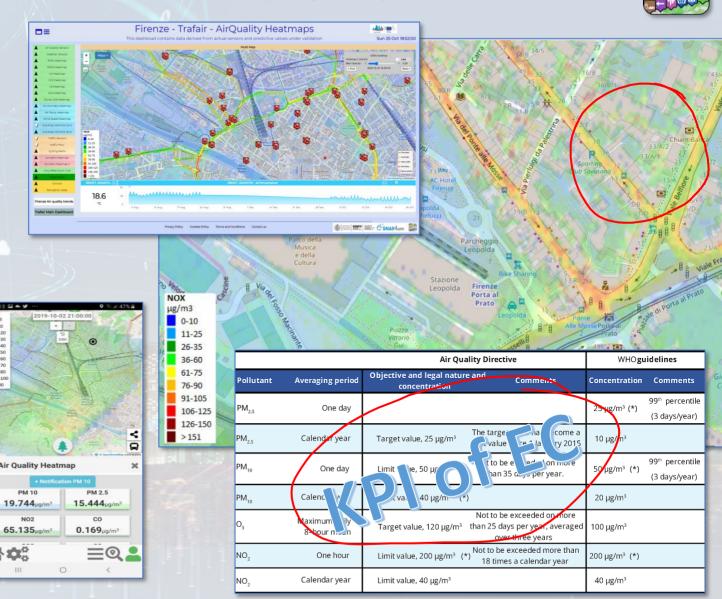
- Pollutant Predictions: NOX, NO2, ..
- City officers, energy industries
- Dashboards, What-IF analysis
- Traffic Flow Reconstruction

Historical and Real Time data

- Billions of Data
- Services Exploited on:
 - Dashboards, Mobile App
- Since 2020

Cities of:

Firenze, Pisa, Livorno





Devices data



Air Quality sensors are

- Collected on scattered positions
- Not all sensors have sull set of data, complexity of computing AQI

AirQuality Services

- AirQuality indicators independent on the sensors' position, in any GPS position of the area
- Multiple data: PM_{10} , $PM_{2.5}$, CO, CO_2 , SO_2 , O_3 , H_2S , NO, NO_2 , NO_{χ} , air temperature, air humidity, velocity of wind speed, dew point, etc.

Applications

- Control Room Rendering
- Alerting on specific personal GPS locations
- Constrained routing for: runners, walking with baby, people with pulmonary problems,
- Mobile Phone Rendering, this means to have thousands of users active at the same time, and a reasonable memory consumption in the server.





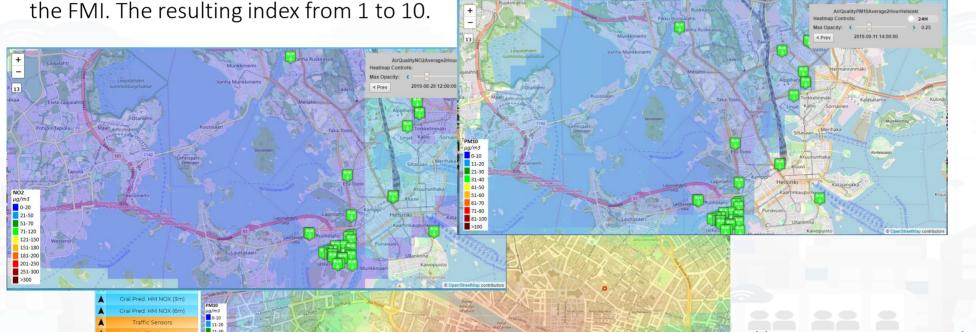




Environmental Real Time Measures

- **Noise:** real time noise levels (measured in dBA).
- **PM**₁₀: real time pollutant levels in air in terms of PM₁₀ (measured in μ g/m₃) particles.
- PM_{2,5}: real time pollutant levels in air in terms of PM_{2.5} (measured in μg/m₃) particles
- NO_2 : real time pollutant levels in air in terms of nitrogen dioxide (measured in $\mu g/m_3$).

Air Quality Index (AQI): real time air quality index of the Helsinki area, provided by



BusStop Ticket sale Traffic Sensor Weather sensor Air Temp heatmap Humidity Heatmap Air Quality Sensors Noise sensors Noise Heatmap PM10 heatmap PM2.5 Heatmap NO2 heatmap Air Quality Index HeatM EAQI HeatM. CAQI HeatM. Enfuser pred. AQI Enfuser pred. PM10 Enfuser pred. PM2.5 Gral pred. PM10 Gral pred. PM10 (6m) PM10 Jätkäsaari PM2.5 Jätkäsaari EAOI Jätkäsaari Appreciated POIs







AQI Indexes estimation via R studio and IOT App

European Air Quality Index EAQI

http://airindex.eea.europa.eu/

Pollutant	Index level (based on pollutant concentrations in µg/m3)				
	Good	Fair	Moderate	Poor	Very poor
Particles less than 2.5 µm (PM _{2.5})	0-10	10-20	20-25	25-50	50-800
Particles less than 10 µm (PM ₁₀)	0-20	20-35	35-50	50-100	100-1200
Nitrogen dioxide (NO ₂)	0-40	40-100	100-200	200-400	400-1000
Ozone (O ₃)	0-80	80-120	120-180	180-240	240-600
Sulphur dioxide (SO ₂)	0-100	100-200	200-350	350-500	500-1250

Measurements of up to five key pollutants supported by modelled data determine the index level that describes the current air quality situation at each monitoring station.

The index corresponds to the poorest level for any of five pollutants according to the following scheme.

Legend of Environmental data:

https://www.snap4city.org/435

Common Air Quality Index (CAQI

http://www.airqualitynow.eu

Qualitative name	Index or sub-index	Pollutant (nourly) density in µg/m ³					
	(NO ₂	PM ₁₀	03	PM _{2.5} (optional)		
Very low	0–25	0=50	0 25	0- 60	0–15		
Low	25–50	50–100	25–50	60–120	15–30		
Medium	50–75	100–200	50-90	120-180	30–55		
High	75–100	200–400	90–180	180–240	55–110		
Very high	>100	>400	>180	>240	>110		

The index is defined away from roads (a "background" index). **CAQI** is computed on the basis of NO₂, PM_{2,5}, PM₁₀ and O₃.





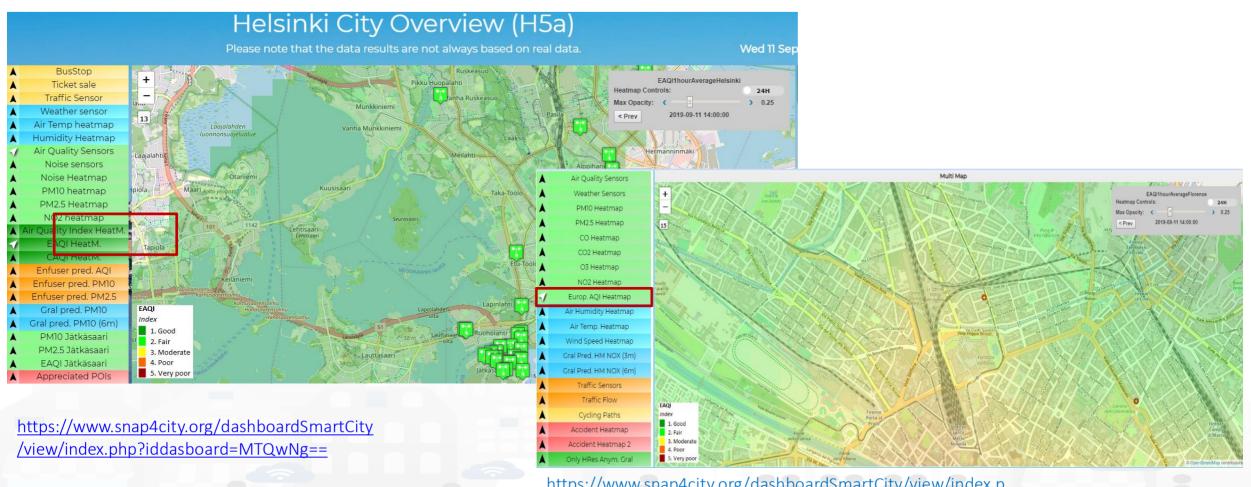






AQI Indexes estimation Heatmaps

Hourly pollutant concentration



https://www.snap4city.org/dashboardSmartCity/view/index.p
hp?iddasboard=MTUzMg==

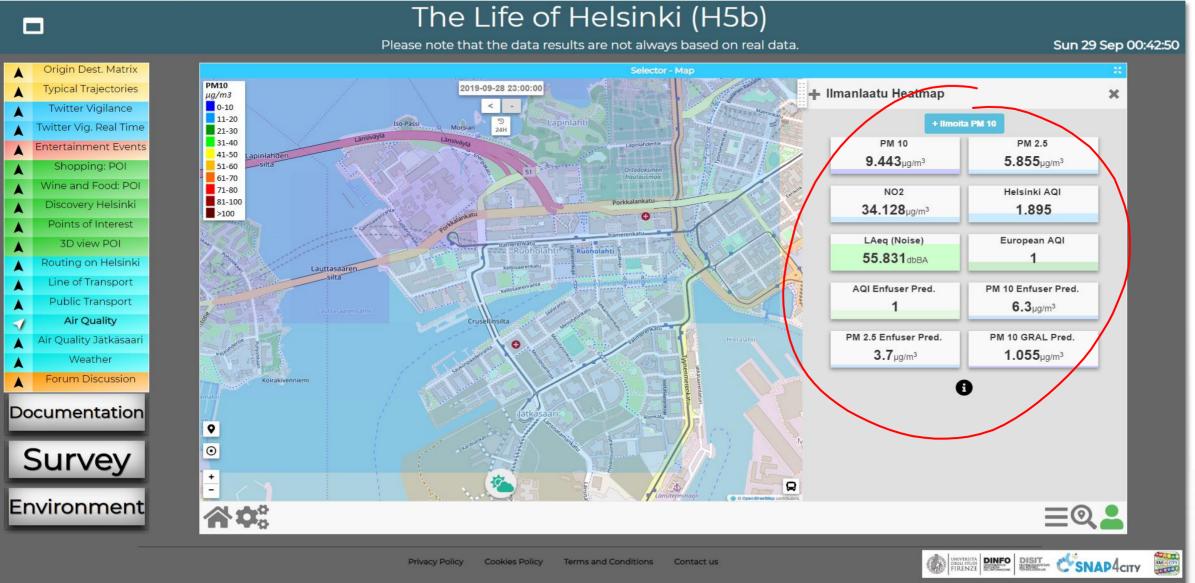






Helsinki



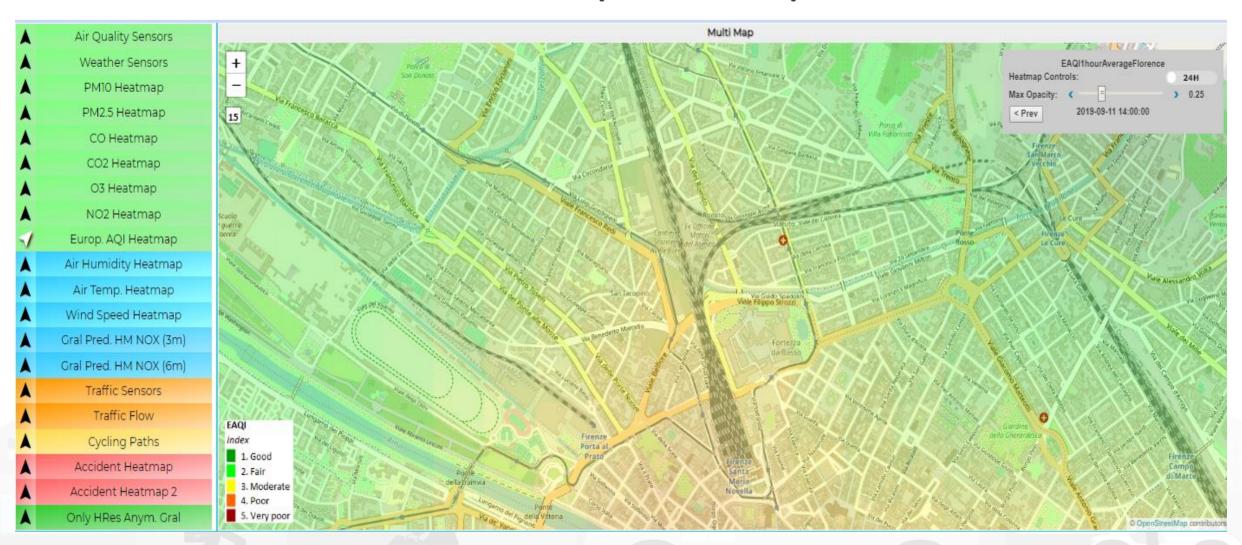








EAQI Heatmap and sequence











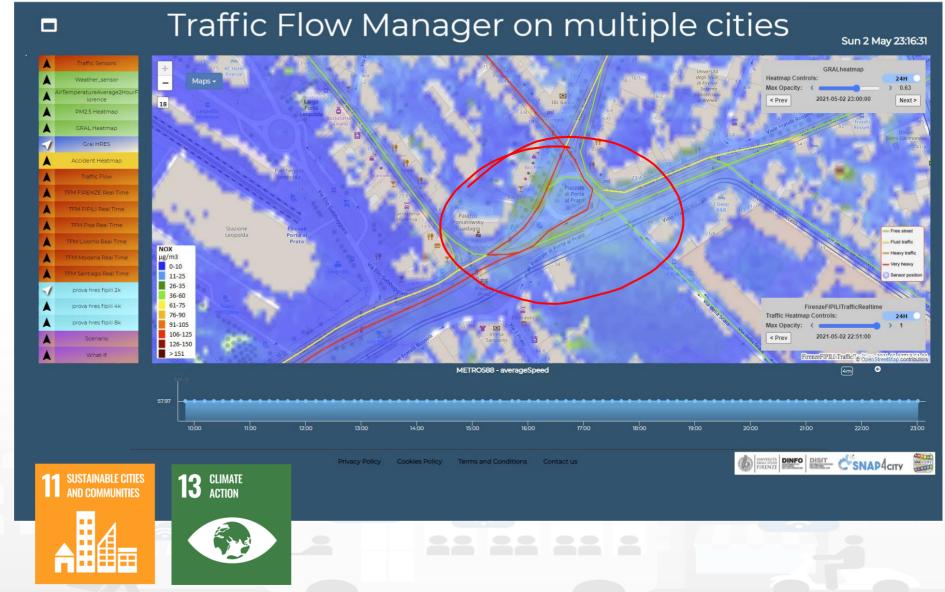


Prediction

- NOX Pollutant diffusion on the basis of Traffic Flow (prediction), weather and 3D structure
- NO2 progressive average (Long term)

Project:

- Trafair CEF EC
- Mixed solutions of Fluidinamics modeling and Al



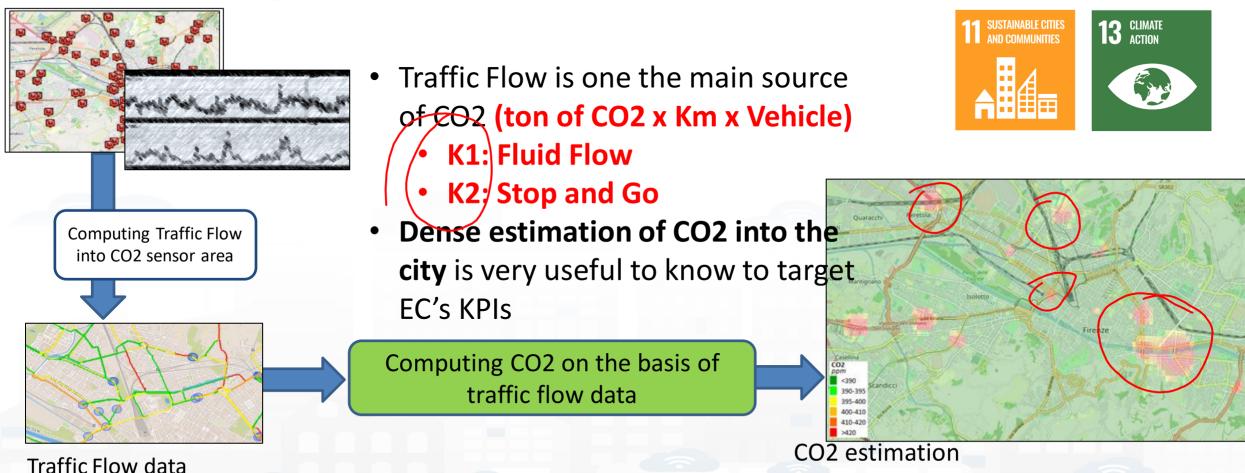








Estimating City Local CO2 from Traffic Flow Data



S. Bilotta, P. Nesi, "Estimating CO2 Emissions from IoT Traffic Flow Sensors and Reconstruction", Sensors, MDPI, 2022. https://www.mdpi.com/1424-8220/22/9/3382/





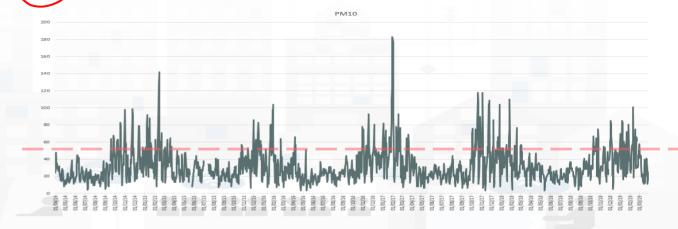




Predicting Air Quality

- European Air Quality Directive
- Predicting critical days
 - PM10 with an accuracy of more than 90% and precision of 85%;
 - PM2.5 with an accuracy of 90% and precision greater than the 95%.
- Simulating Long terms values
 - For long terms predictions

		Air Quali	WHOguidelines		
Pollutant	Averaging period	Objective and legal nature a concentration	and Comments	Concentration	Comments
PM _{2.5}	One day			25 μg/m³ (*)	99 th percentile (3 days/year)
PM _{2.5}	Calendar year	Target value 25 ug/m³	The target value has become a imit value since 1 January 2015	10 μg/m³	
PM ₁₀	One day	Limit value, 50 µg/m³	Not to be exceeded on more than 35 days per year.	50 μg/m³ (*)	99 th percentile (3 days/year)
PM ₁₀	Calendar year	Limit value, 40 μg/m³ (*)		20 μg/m³	
O ₃	Maximum daily 8–hour mean	Target value, 120 μg/m³ ti	Not to be exceeded on more han 25 days per year, averaged over three years	100 μg/m³	
NO,	One hour	Limit value, 200 μg/m³ (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m³ (*)	
NO ₂	Calendar year	Limit value, 40 µg/m³		40 μg/m³	







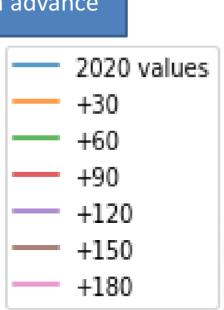




Predicting EC's KPI on NO2 months in advance

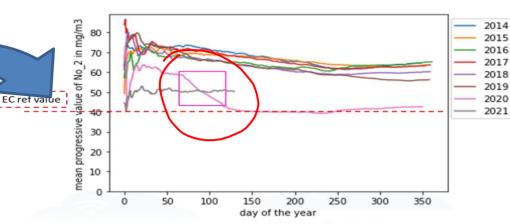
Deep Learning Long Terms Predictions of NO2 mean values, From 30 to 180 days in advance

- The features used as input for the predictive models are:
- Month
- dayOfTheYear
- NO2
- Tmean
- Humidity
- windMean
- NoxDomestic
- numberOfVehicles
- NO2cumulated
- NO2progresseveMean
- numberOfVehiclesCumulated









		Air Quality Directive			WHOguidelines	
Pollutant	Averaging period	Objective and legal nature concentration	and Comments	Concentration	Comments	
PM _{2.5}	One day			25 μg/m³ (*)	99 th percentile (3 days/year)	
PM _{2.5}	Calendar year	Target value 25 ug/m³	The target value has become a limit value since 1 January 2015	10 μg/m³		
PM ₁₀	One day	Limit value, 50 µg/m³	Not to be exceeded on more than 35 days per year.	50 μg/m³ (*)	99 th percentile (3 days/year)	
PM ₁₀	Calendar year	Limit value, 40 µg/m³ (*)		20 μg/m³		
O ₃	Maximum daily 8–hour mean	Target value, 120 µg/m³ t	Not to be exceeded on more than 25 days per year, averaged over three years	100 μg/m³		
NO ₂	One hour	Limit value, 200 μg/m³ (*)	Not to be exceeded more than 18 times a calendar year	200 μg/m³ (*)		
NO ₂	Calendar year	Limit value, 40 μg/m³		40 μg/m³		



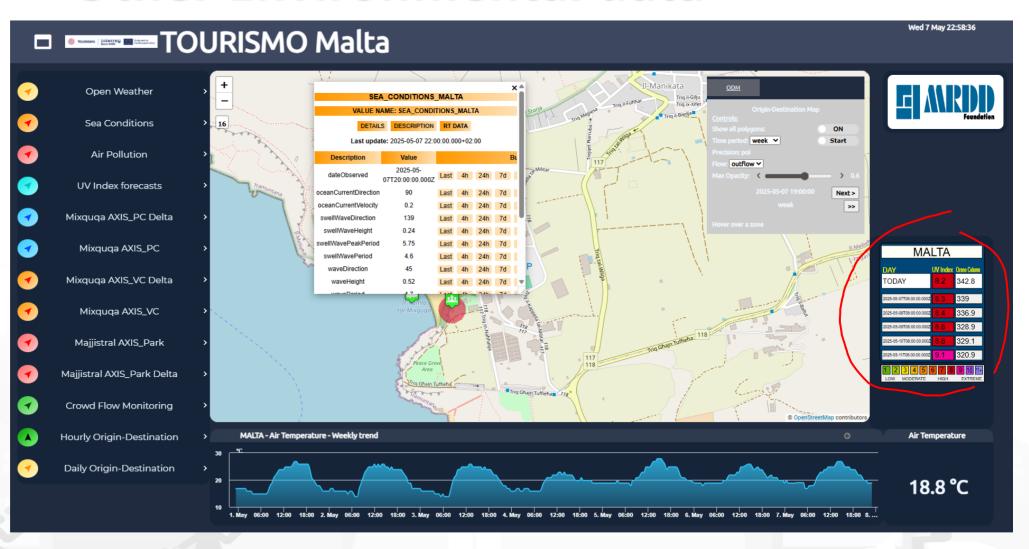






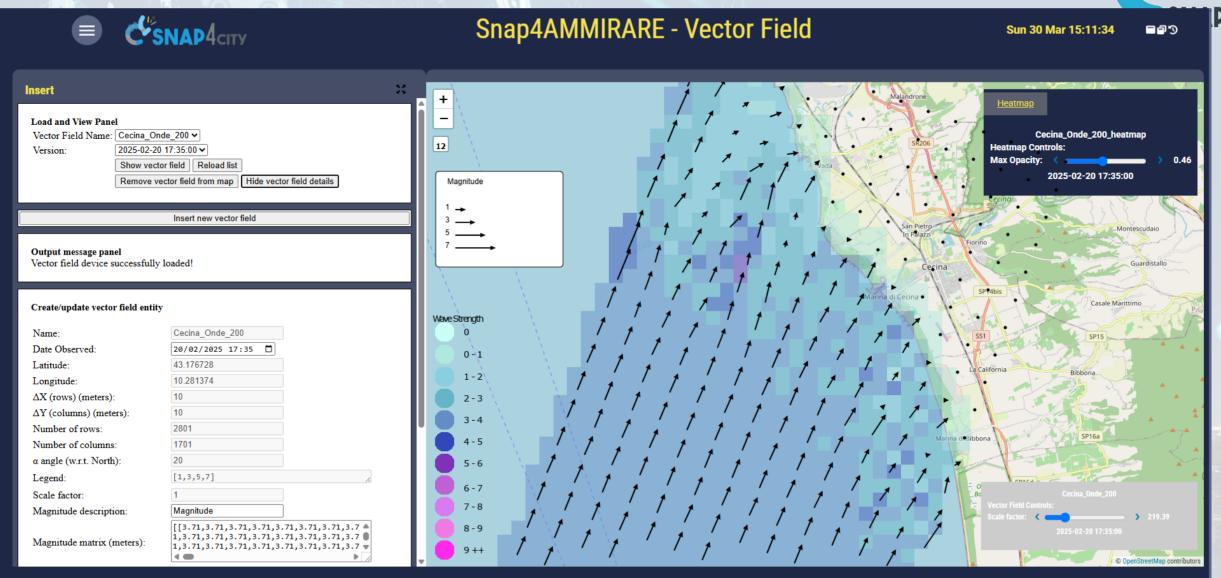
Other Environmental data

- SeaConditions
- UB Index
- Ozone
- Pollution
- Weather
 Forecast



Monitoring Costal Bathymetry and Waves













Early Warning, Detection











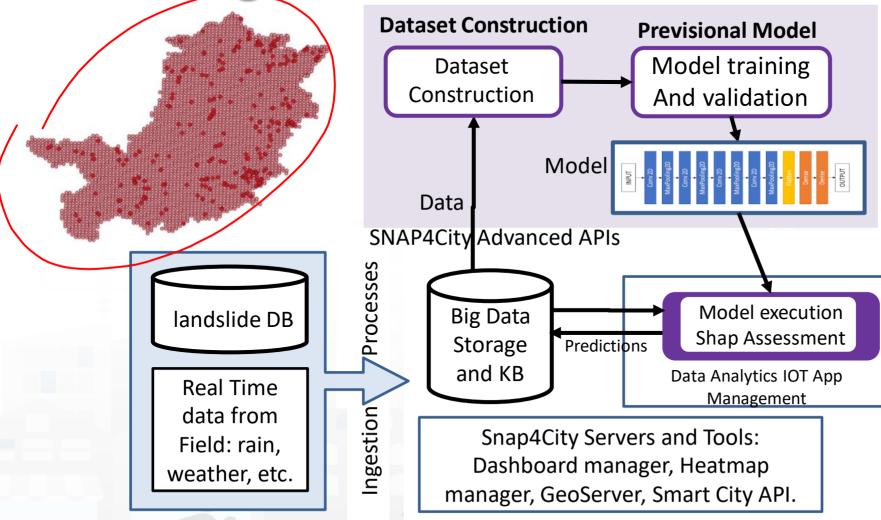








Predicting Land slides



(a) 21-12-2019 predictions

Dashboards and

Mobile Apps

E. Collini, L. A. I. Palesi, P. Nesi, G. Pantaleo, N. Nocentini and A. Rosi, "Predicting and Understanding Landslide Events with Explainable AI," in IEEE Access, doi: 10.1109/ACCESS.2022.3158328





Local Explainable AI - understanding the single event

- The local explanation puts in evidence the features which provided major contribution to the prediction
- For example considering
 Figure 10a, the value of
 VelMaxSIR, MaxTempSIR, Day3
 and Humidity contributed
 significantly to the classification of
 the observation as a landslide
 event

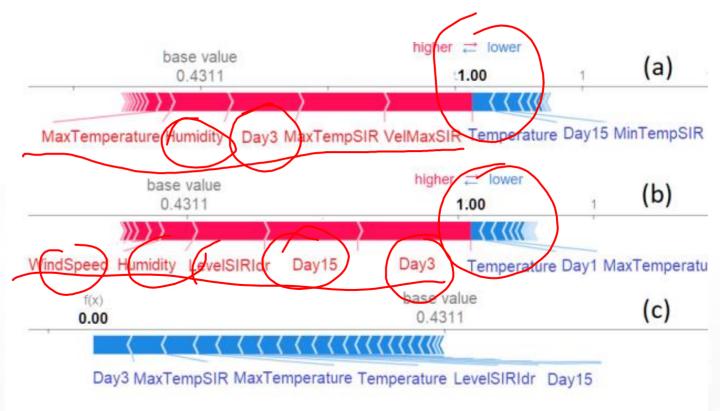


FIGURE 10. Local feature relevance via SHAP, as interpretation of events in terms of feature values: (a) and (b) are events with predictions of landslide, (c) a no landslide event.



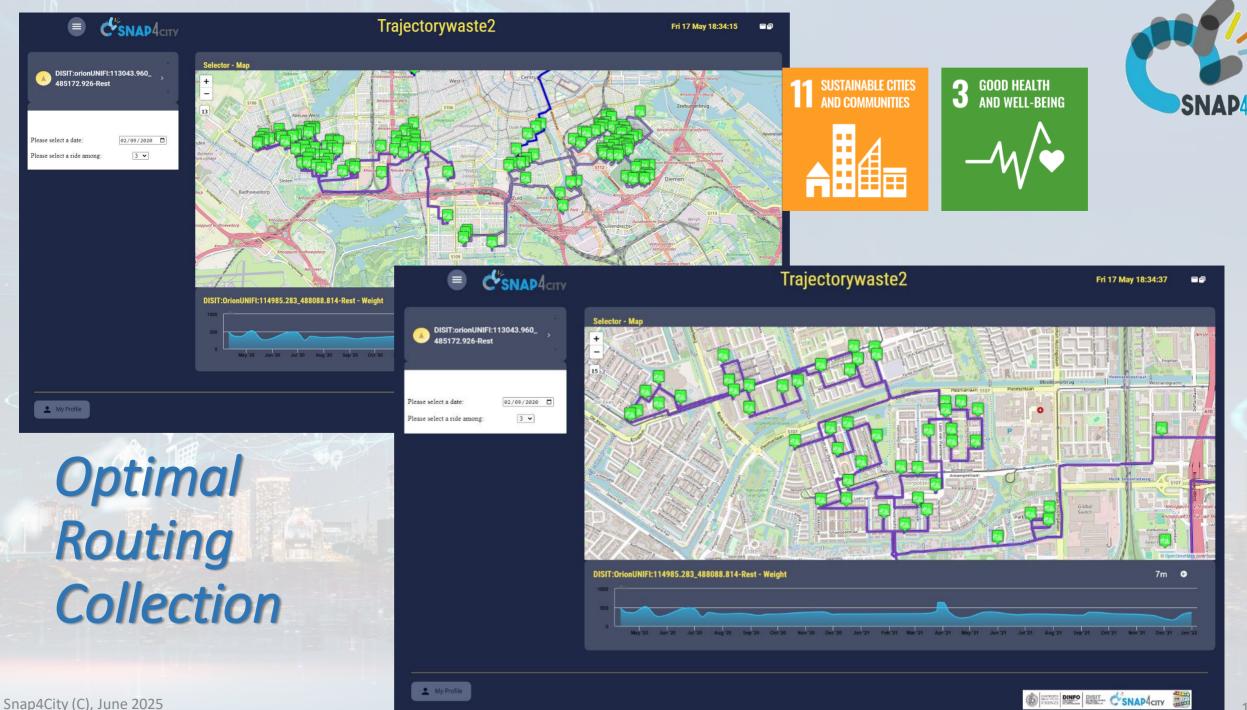


Smart Waste



Waste Manager:

- Collects and monitors data from bins (status, temperature, and a number of alarms, etc.) and trucks (weights collected, when possible) according to differentiated waste collection;
 - Interoperable with different waste bin sensors and lockers.
 - Monitor waste bin status including alarms of critical conditions notified from the citizens, and/or detected by sensors such as: fire, up-side-down, hurts, too filled, run out of battery, errors, etc. (some of these events can be enabled on the basis of the sensors positioned to the bin)
- **supports of policies** as Pay As You Throw, PAYT, provided that the bins are controlled with fobs, NFC, rfid, etc.
- **promoting citizen engagement/participation**, to help cities optimize their waste management practices and move towards a more sustainable future. The engagement is especially addressed to the city commercial operators which have special need in providing a large amount of waste (such as restaurants, fast food, bars, and shopping centers). https://www.snap4city.org/1018
- Reduce costs: optimize waste collection and management in urban environments
 - identify the bins that risk to become full in advance (using predictive technologies based on AI, Deep Learning).
 - Computer the optimal path for waste collection provided to map on mobiles, reduction of costs for waste collection.
 - dashboards provides statistics and forecast.
- Custom user interface and theme can be defined for each municipality as usual on Snap4City.

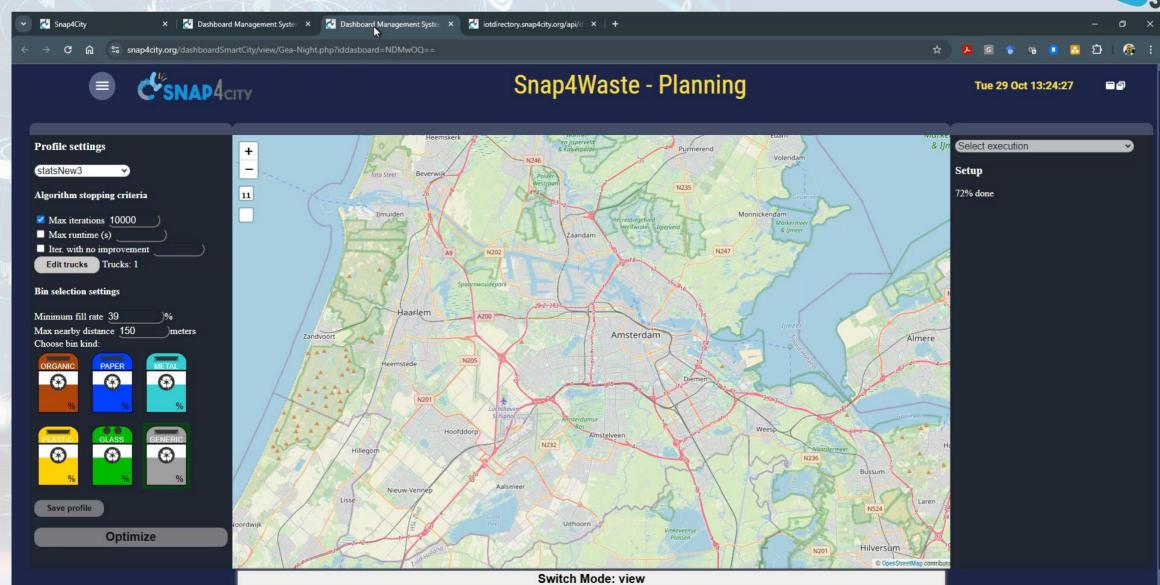


Waste Collection Optimization











Details





FREE

















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Digital Twin Solutions for Sustainability

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS

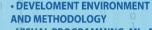








VISUAL PROGRAMMING, ADAPTERS
DATA FLOWS, WORKFLOWS
PARALLEL DISTRIBUTED PROCESSING
DATA DRIVEN



- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES
- LIVING LABS
- GUI CUSTOM STYLES
- FULL APPLICATIONS, DASHBOARDS
 AND VIEWS
- · MOBILE APPS











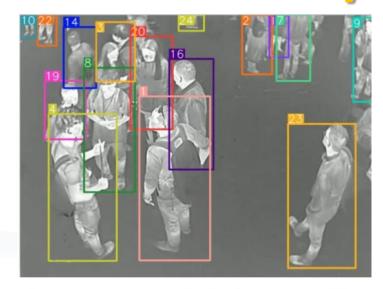


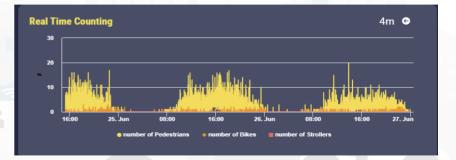




DEGLI STUDI FIRENZE DIPARTIMENTO DI DISTRIBUTED SYSTEMS AND DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB LY User Behaviour/services, Tourism and Safety

- Improve Quality of Life and quality of services.
- Over tourism mitigation, sustainability
- Costs reduction of services
- Improve accessibility to services: citizens, Tourists, commuters, etc.
- Improve Security/Safety of city users
- People Flow Analysis / Management: in/out-door, retail, attractions
 - Counting, tracking, Flows, ODM, sentiment, recency/frequency, etc.,
 - multiple sources: thermal & TV cameras, radar sensors, PAX sniffers, mobile data, ...
 - Data and/or **OD matrices** from: Wi-Fi, traffic data, mobile phone data
 - **Suggestions**: info Tourism, digital signages, engagement, ...
- Tourists Flows & Retail Management: predictions of presences, services' reputations, suggestions on second offer, over-tourism, notifications, early warning,
- KPI: 15 MinCityIndex, energy vs people, over-tourism, accepted suggestions, precision
- **Mobile App:** final users services/informing and operators
 - Info Tourism, people flows, info mobility, sharing, ...
 - Participation, engagement, ...
- **Participatory**: problem reporting, ticketing, etc.
- Integration of any kind: env/weather, mobility, ticketing, presences, POI, ...













• Goals:

City User Behaviour/services, Tourism and Safety (2024/8)

- Quality of Life, quality of services, over tourism mitigation, sustainability
- Costs reduction of services
- Accessibility to services: citizens. Tourists, commuters, etc.
- Security/Safety of city users
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - People Mobility Demand via Origin Destination Matrices
 - Monitoring services: tickets, reputation, usages, areas, etc.
 - Monitoring user behaviour (counting, trajectories): indoor/outdoor, hot places/services, ports, beaches,
 - Computing: origin destination, trajectories, travel means, etc.
 - Early detection/warning of critical conditions, connection with Video Management Systems
 - Managing entrances in city areas: restricted areas, touristic busses, etc.
 - Production of info-toursim, recommendations, nudging to city users and operators, second offer promotion
 - Providing Virtual Assistants for City Services, Tourist Offices, etc.
 - Monitoring reputation of services via: social media, blogs, etc.
 - Collecting complains, requests, participations from City users via mobile apps
 - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
 - Reduction of Pollutant Emissions, via optimization
 - Optimization plan to distribution of workload on multiple touristic offers/services, area cleaning, etc.
 - Predicting reputation of services, touristic and operative





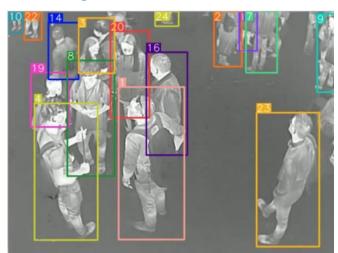






City Users Behaviour, Safety, Security and Social Analysis (2024/8)

- People detection and classification: persona, strollers, bikes, etc. (ML, DL)
- people counting and tracking, head counting, people trajectories (via thermal cameras, ML, DL)
- People flows prediction and reconstruction, (ML, DL)
 - Wi-Fi data, mobile apps data, Mobile Data, etc.
- User's behaviour analysis, People flow analysis from PAX Counters and heterogenous data sources (ML, AI)
 - origin destination matrices, hot places, time schedule,
 - Recency and frequency, permanence, typical trajectory, etc.
- Computing User engagement and suggestions for sustainable mobility (Rule Based, ML)
- Social media analysis on specific channel, specific keywords: see Twitter Vigilance,
 - Reputation, service assessment: MultiLingual NLP and Sentiment Analysis, SA
 - Tweet proneness, retweet-ability of tweets, impact guessing
 - Audience predictions on TV channels and physical events, locations
 - Prediction of attendance of events and on attractions
- Virtual Assistant construction, LLM, NLP, Sentiment Analysis (DL, NLP)
- Video management System integration for security
- 15 Minute City Index , etc. (modeling and computability)
- Computing SDG, etc., (DP)





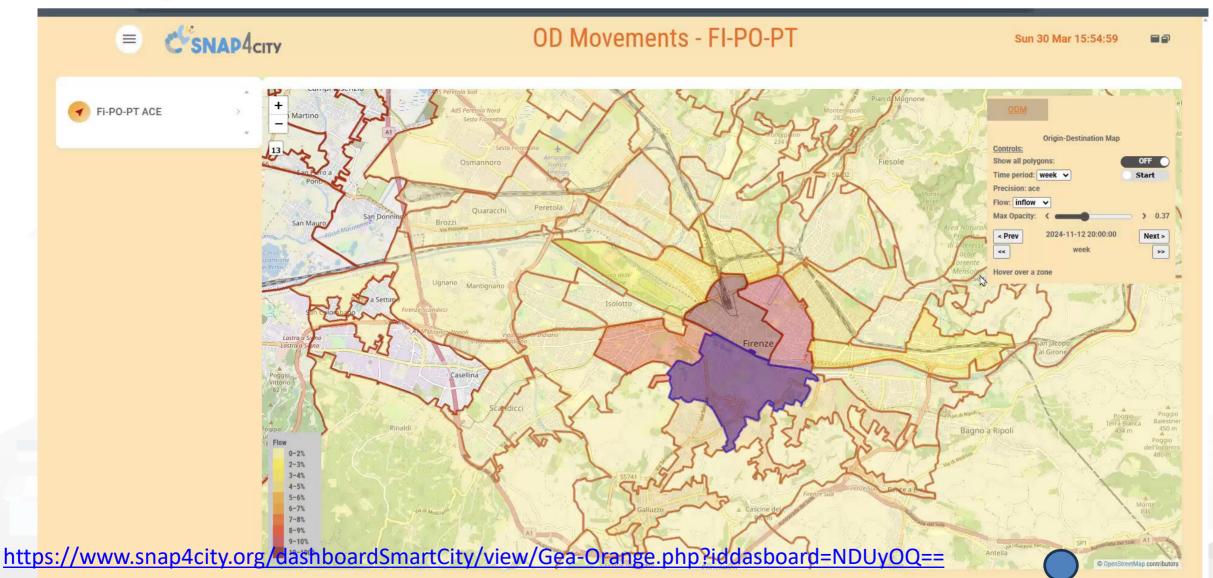








Origin Destination Matrices: Mobility Demand

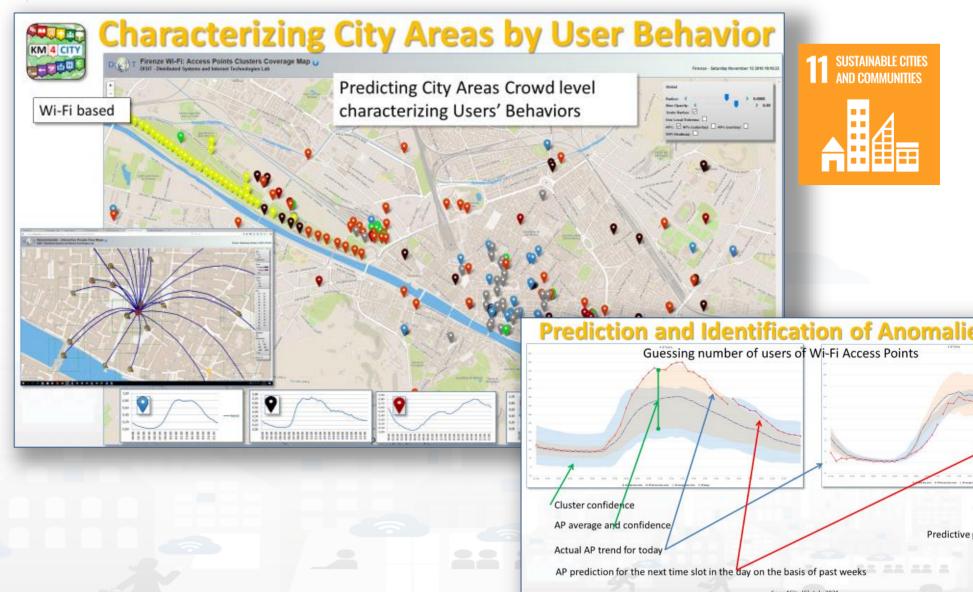








- Prediction of people flows on the basis of Wi-Fi data
- Anomaly detection
- Resolute H2020
- Classification of city areas



User Behaviour: People Counting, Tracking, etc. SNAP4city



Behavior analysis in open or closed spaces

- HUB, metro, stations, production lines, parking lots, critical areas in cities,
- shopping centers, retail, etc.

Thermal Cameras

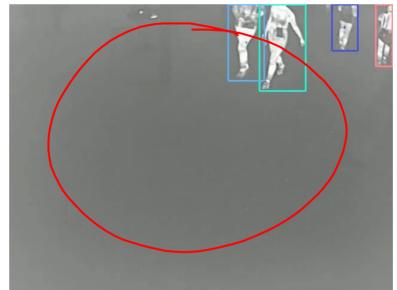
GDPR compliant

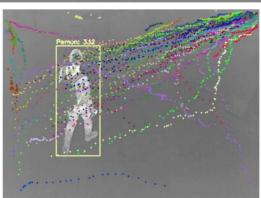
AI injection

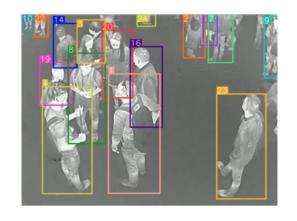
- classification and counting
- Identification of critical situations
- Early warning
- Integration with PAX counters, and with ODM data from operators

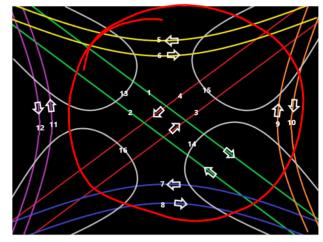
Real-time estimation

- Directly on the camera
- High precision and reliability
- Used by: Cuneo, Florence, Genoa, etc



























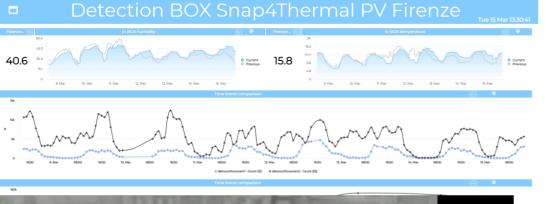








A view and data from the Thermal Camera











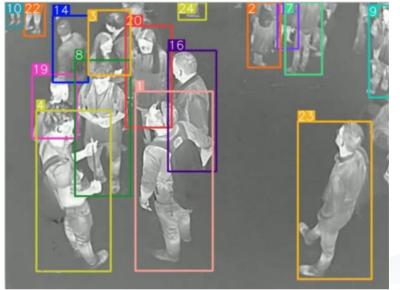


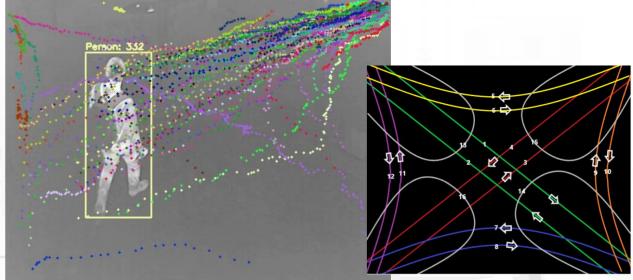




People Counting and Tracking











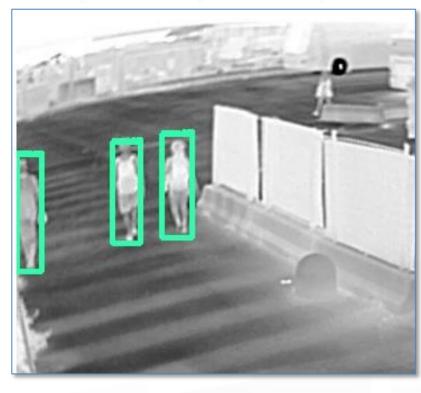










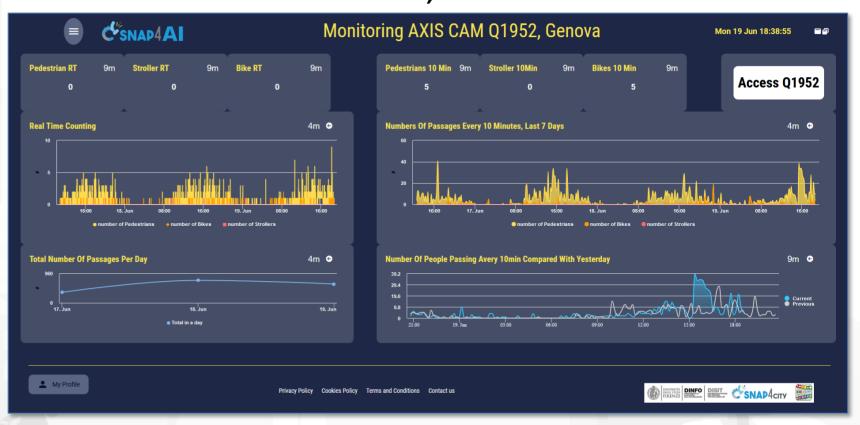


SUSTAINABLE CITIES

Monitoring Passages AXIS Q1952



• Genova: Ocean Race, 2023





Valencia, FSMLR

Tourism Domain

- Counting People
- Environmental data
- Social Media

Dashboards

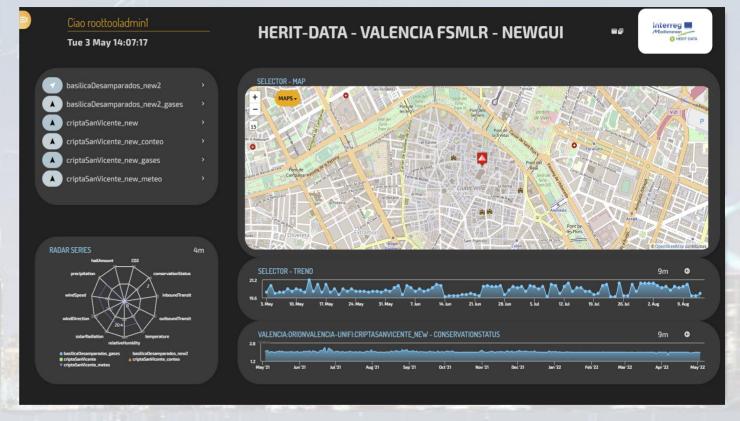
- Monitoring and real time control
- People flow
- Twitter Vigilance
- Historical and Real Time data
- Services Exploited on:
 - Dashboard
- Since 2020









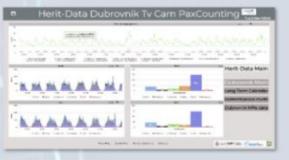


Dubrovnik

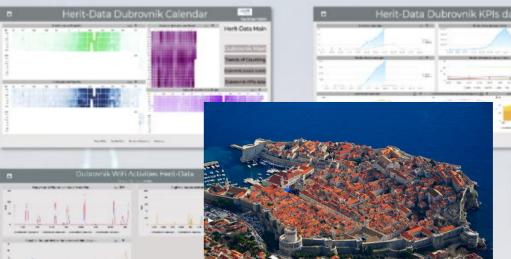
- Tourism Domain
 - Counting People
 - TV Cameras and WiFi
 - Social Media
- Dashboards
 - Monitoring and real time control
 - People flow
 - Twitter Vigilance
- Historical and Real Time data
- Services Exploited on:
 - Dashboard
- Since 2020



















Pont du Gard

Tourism Domain

- KPIs
- Social Media
- People Flows
- Bike Flows
- Dashboards
 - Monitoring KPI
 - People and bikes flows
 - Twitter Vigilance
- Historical and updated data
- Services Exploited on:
 - Dashboard
- Since 2020











Pilots of Snap4City on:

· Greece - READ S.A.: Rodi

• Italy - FRI, UNIFI: Firenze

• Spain - FV, FSMLR: Valencia

• Cyprus - ANELEM: Limassol

• Bulgaria - VEDA: Varna

• Croatia - RERA SD: Splitskodalmatinska županija

• Malta - MRDDF: La Valletta





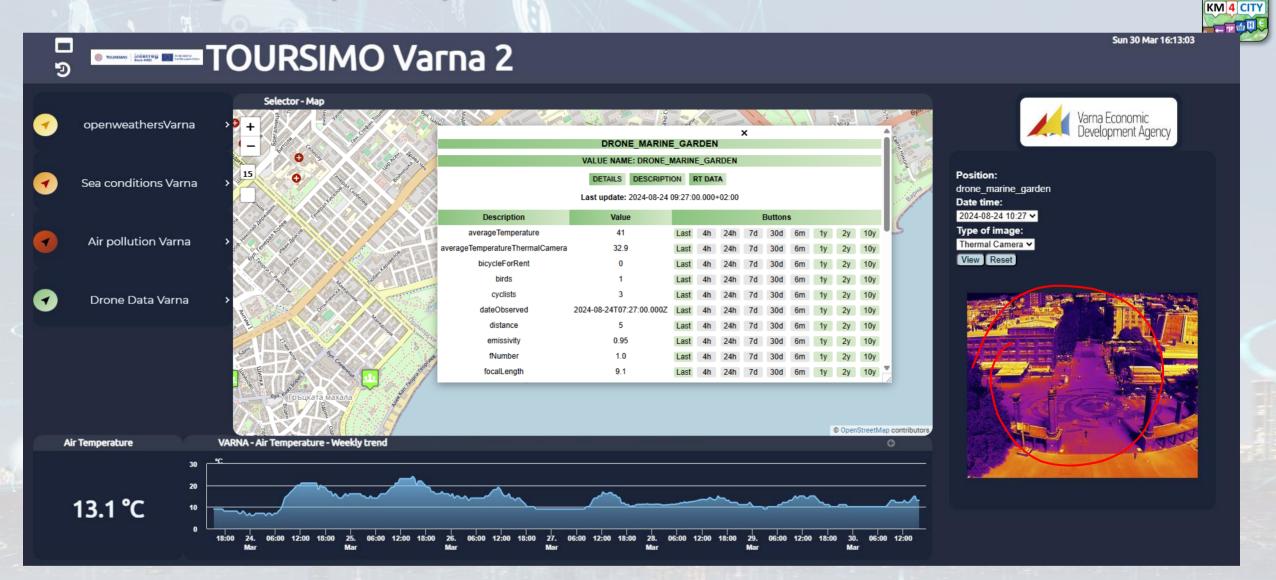






Counting People by Drones in Varna





https://www.snap4city.org/dashboardSmartCity/view/newTheme.php?iddasboard=NDUxOA==

156



Tracking People vs Environment in Malta





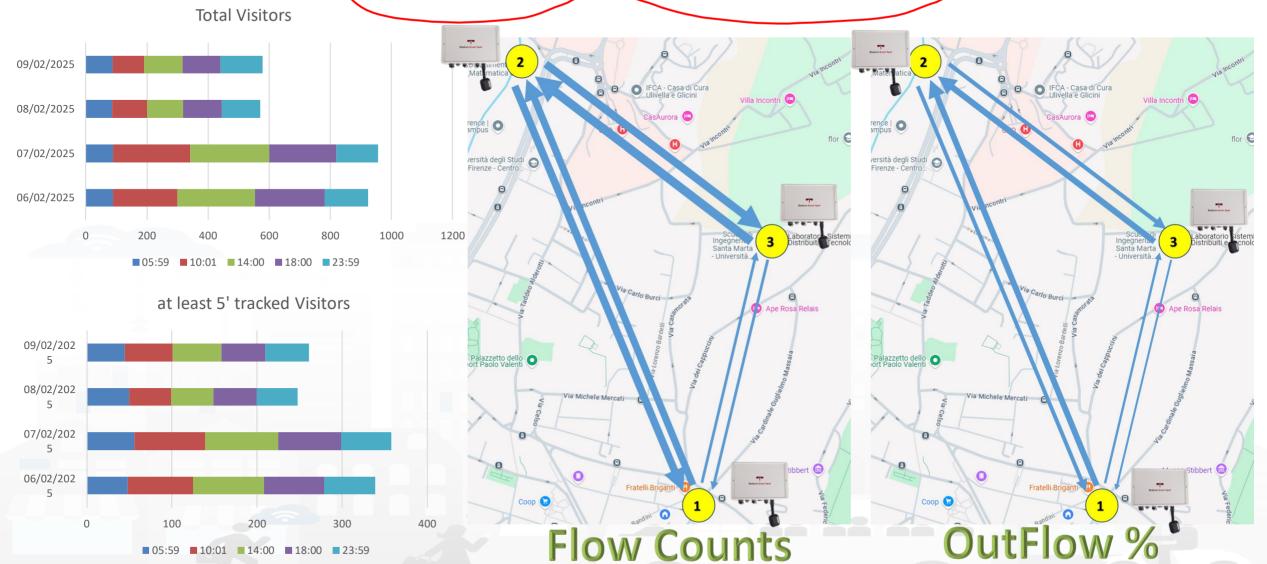


DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE



Libelium PaxCounters

















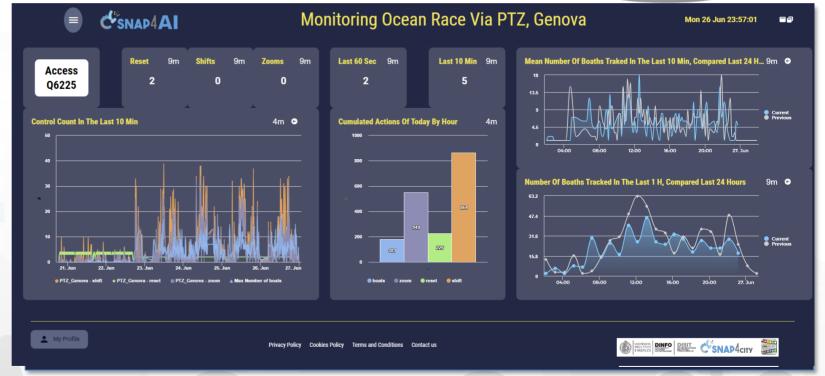


Monitoring Boats AXIS Q6225

Genova: Ocean Race, 2023









Details

Tools for rapid implementation of - Sustainable Smart Solutions - Decision Support Systems as a no-coding, low-coding





info@disit.org https://www.Snap4city.org, https://www.Snap4Industry.org

Snap4City (C), June 2025 160





FREE TRIAL











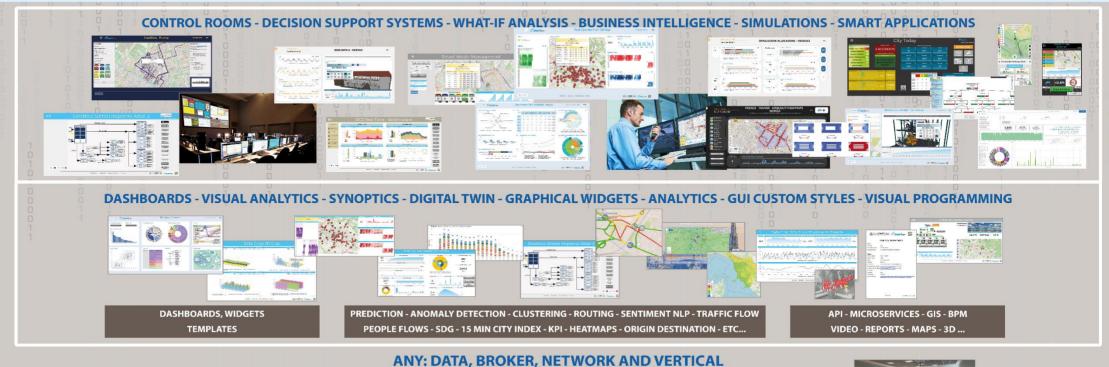








SNAP4INDUSTRY Smart Solutions and Decision Support Systems







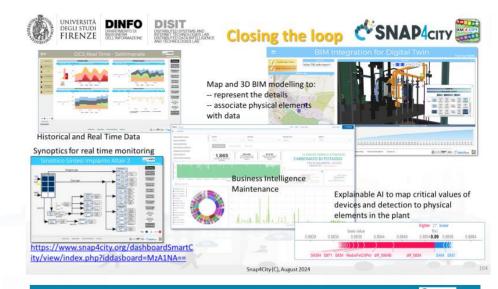


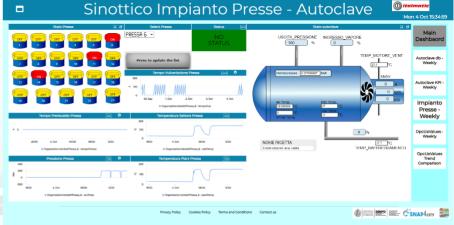




Industry production Domain (2025/5)

- Goals:
 - Cost reduction, increase control on production
 - Production optimisation
 - Quality Level
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring KPI: administration, production, commercial, faults, etc.
 - Early detection/warning, alarm, of critical conditions.
 Multichannel Event reporting: email, Telegram, mob apps, etc.
 - Managing maintenance operation, predictive maintenance
 - Simulation of Fluid dynamic on Autoclaves
- Solutions for Planning (optimization and what-if analysis)
 - Generative AI and predictive AI for production plan optimisation
 - Reduction maintenance costs, reduction of critical SLA conditions, improving quality level
- Algorithms and computational solutions

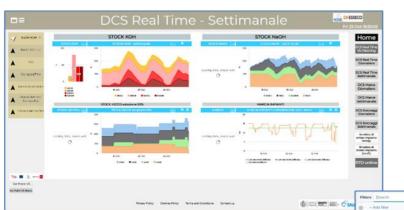




Predictive Maintenance







Map and 3D BIM modelling to:

- -- represent the details
- -- associate physical elements

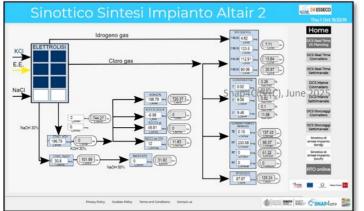
Business Intelligence

Maintenance

with data

Historical and Real Time Data

Synoptics for real time monitoring



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA1NA==









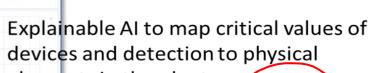


Value 786 with trend

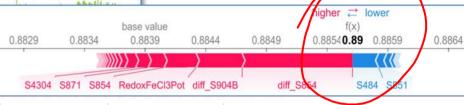
CARBONATO DI POTASSIO



DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE







Snap4Altair Decision Support supervision and control, Industry 4.0







Multiple Domain Data

• Distributed Control System: energy, flows, storage,

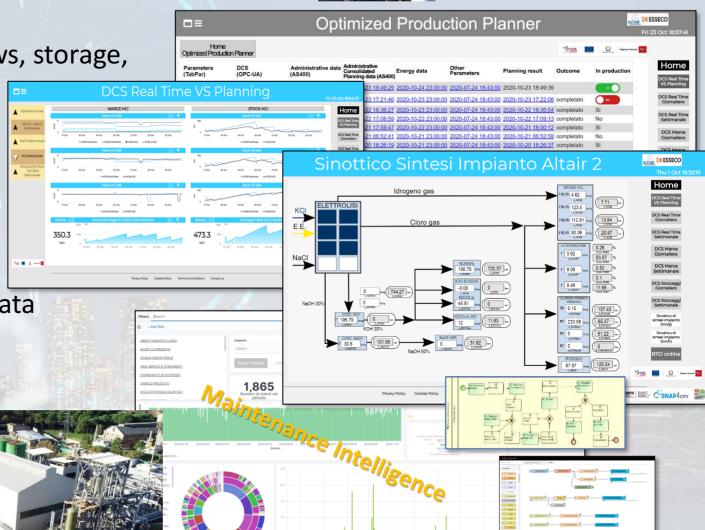
chemical data, settings, ...

- · Cost of energy, Orders,
- Production Parameters
- Maintenance data

Multiple Levels & Decision Makers

- Optimized planning on chemical model
- Business Intelligence on Maintenance data
- Historical and Real Time data
 - Billions of Data
- Services Exploited on:
 - Multiple Levels, Mobile Apps, API

Since 2020



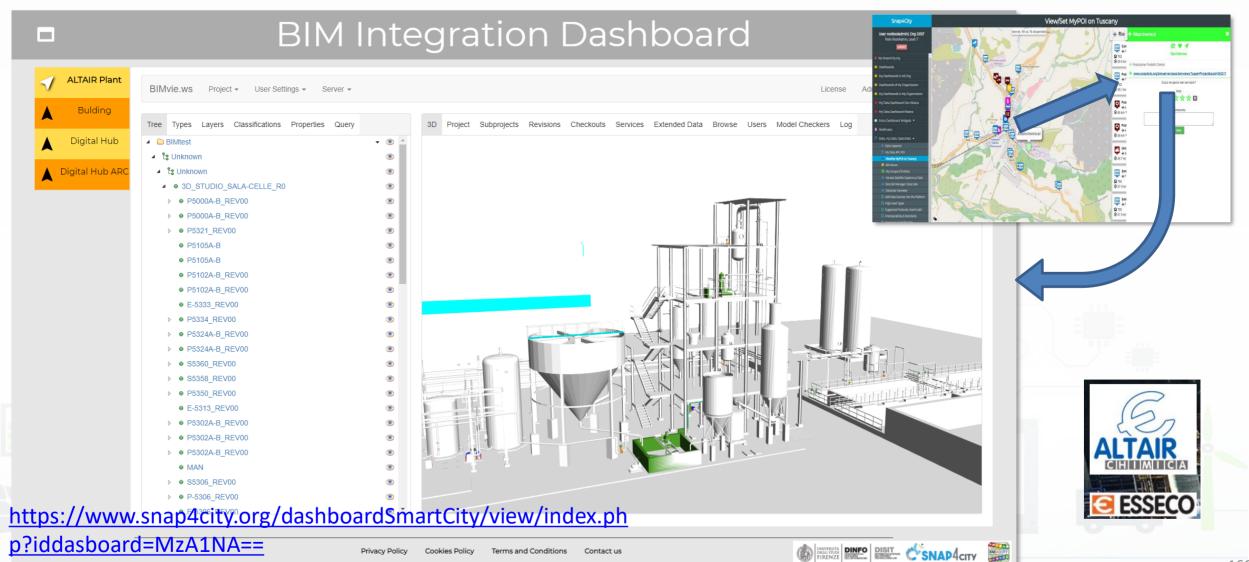








BIM view of the Altair Chemical Plant



Snap4City (C), June 2025

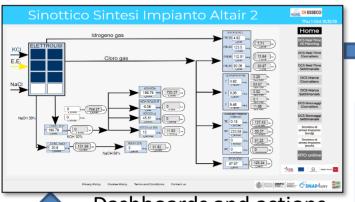




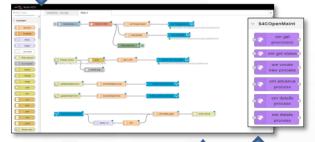




Workflow for Ticket management

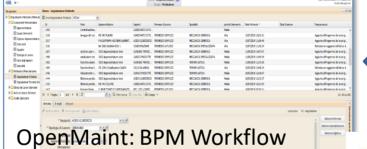


Dashboards and actions

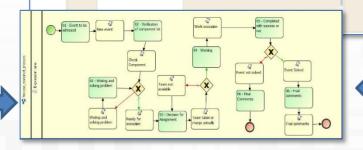


IOT App, Data event firing, event detection and firing Critical event management



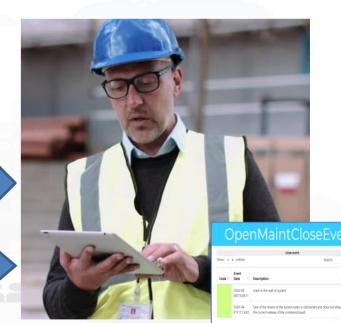


OpenMaint: BPM Workflow management, team assignement, material control, ...



Events/actions







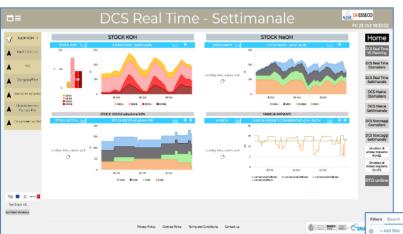




Closing the loop



BIM Integration for Digital Twin



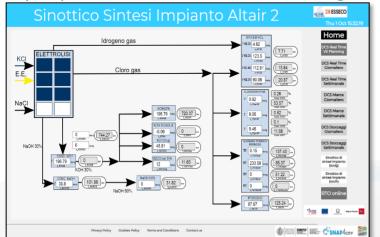
Map and 3D BIM modelling to:

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- -- associate physical elements

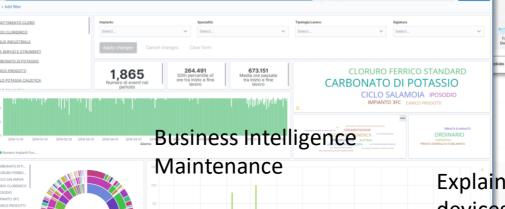
with data

Historical and Real Time Data

Synoptics for real time monitoring



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA1NA==



Explainable AI to map critical values of devices and detection to physical elements in the plant



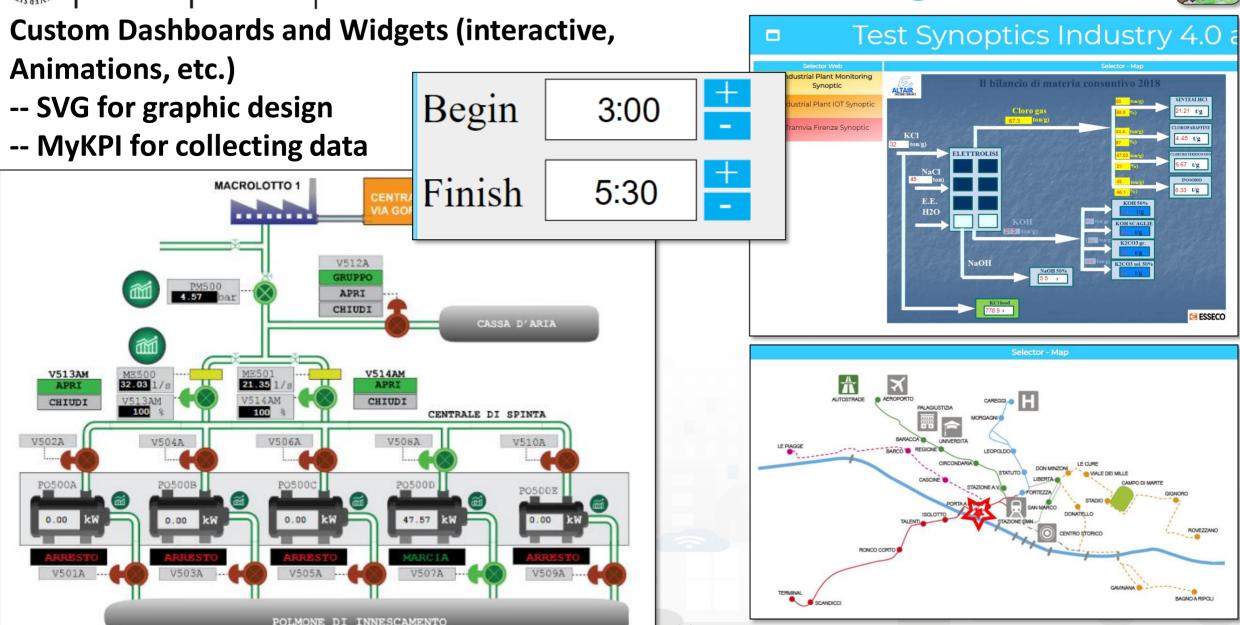
DINFO DISIT CSNAP4CITY





DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB CUSTOM Widgets





Snap4City (C), June 2025

EN.TE.R.PR.I.S.E.

(**EN**hanced **TE**chnological **R**&D of new **PR**oducts and Processes for Innovation, **S**mart factory and green **E**conomy)

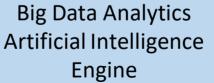




Administrative Data from AS400

Real Time Data, Historical, Events from DCS

Unique National Energy Costs (PUN)











Analytical Data from the product quality Lab (LIMS/SAM)



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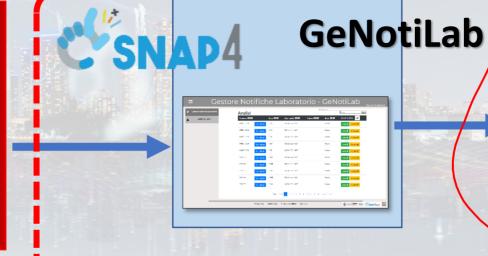






Regione Toscana







GeNotiLab Architecture for ALTAIR





Analytical Data from the product quality Lab(LIMS/SAM)

AS400

IOT App



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Users **Analysis Notifications**



IOT App Analytics

Dashboards



IOT App Management



Tools: -- List of Chemical Analyses

- -- List of Notifications
- -- Define notifications
- -- Program, send notifications
- -- see notification status



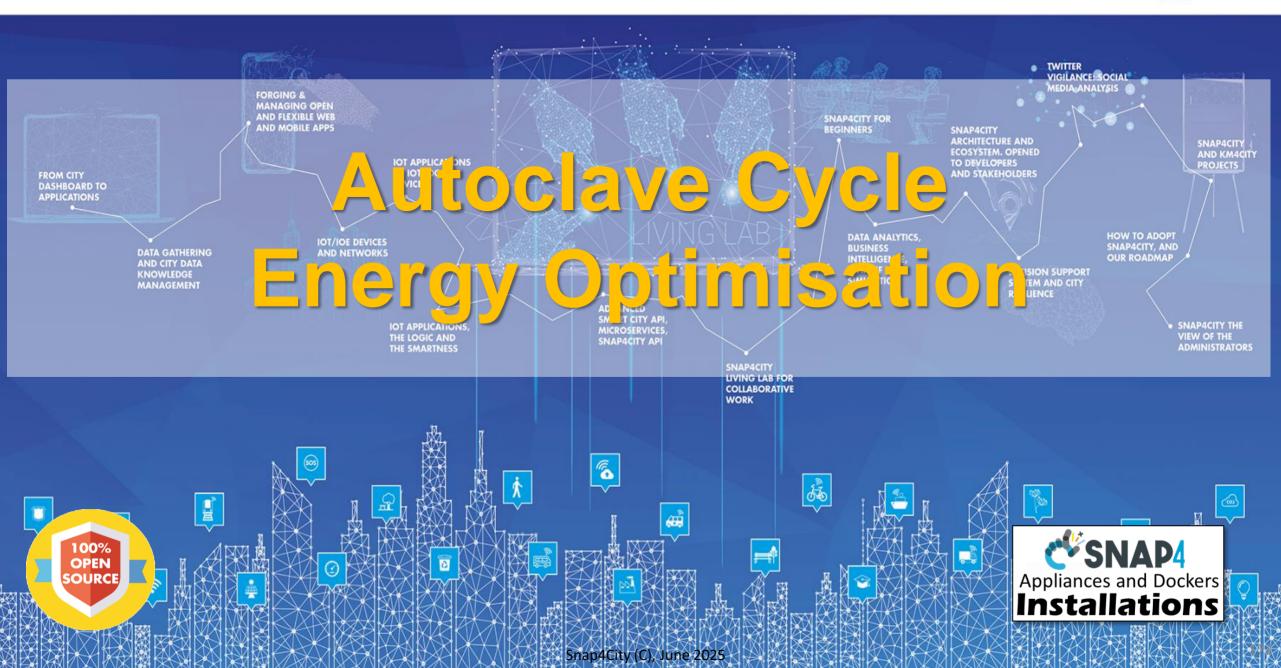
Telegram Bot



Snap4City (C), June 2025

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES





Smart Manufacturing

- Autoclave: curation process for: composite materials, rubber, ...
 - Reduction of computing costs for simulating load effect into the autoclaves curing process
 - Similar to design problems to be validated in wind galleries
- Solving Navier-Stokes PDE (partial differential equations) equation,
 - PINN plus new Transfer Learning techniques
 - Precision on steady and transitory cases
 - Validation wrt Open Foam
 - Reduction of computational time
- Videos on https://www.snap4city.org/1010

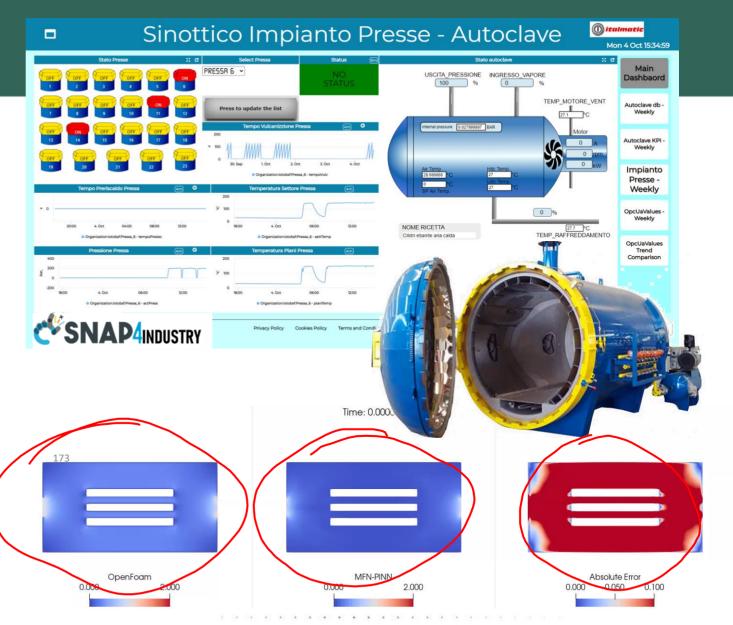












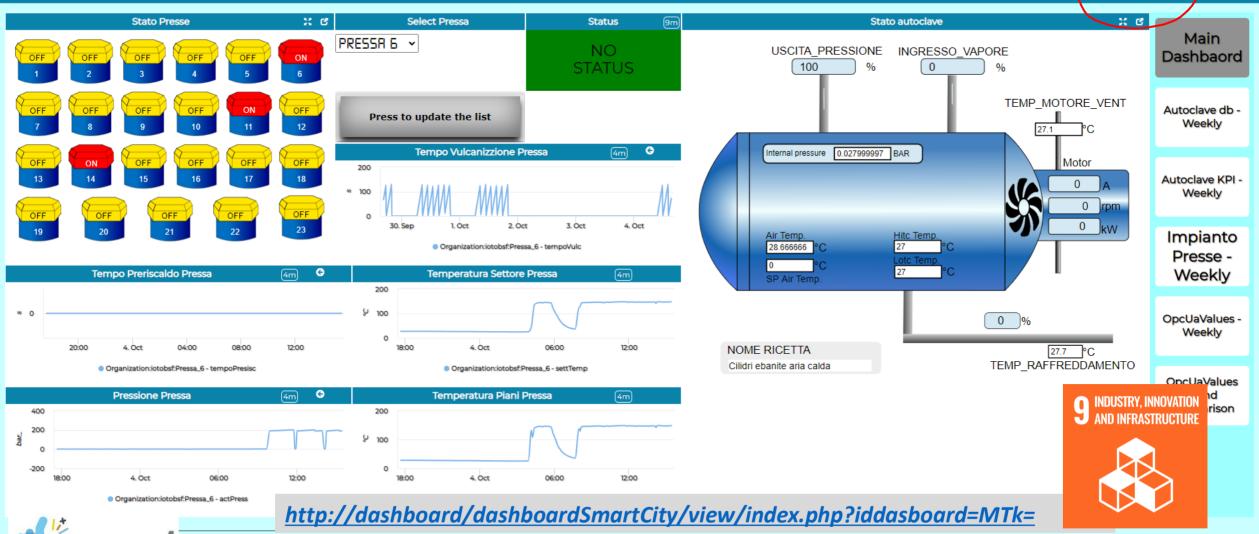


Sinottico Impianto

Sinottico Impianto Presse - Autoclave

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Mon 4 Oct 15:34:59



















PINN: Physically Informed Neural Neworks Models

• **Solving Navier-Stokes PDE** (partial differential equations) equation, **via PINN** approach

Reduction of computing costs for simulating load effect into the

autoclaves curing process

Validation wrt Open Foam

- Precision on steady and transitory cases
- Definition of Transfer Learning techniques
- Videos on https://www.snap4city.org/1010



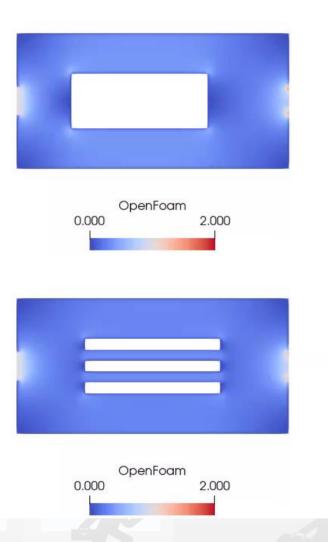




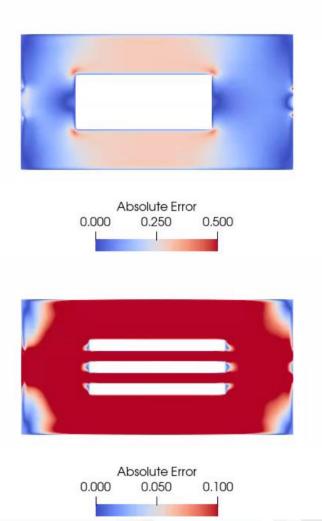




Comparison of PINN vs@penFoam and error













Be smart in a SNAP!





CONTACT

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