



[www.snap4city.org](http://www.snap4city.org)  
[www.snap4solutions.org](http://www.snap4solutions.org)

[www.km4city.org](http://www.km4city.org)

# *AI Digital Twin Platform for Sustainable Decision Support Systems & Business Intelligence tools*

*Paolo Nesi: [paolo.nesi@unifi.it](mailto:paolo.nesi@unifi.it)*

SMART CITY & SMART MOBILITY  
La città del futuro

MONTECATINI TERME 03.05.24 17:30  
HOTEL ADUA VIA MANZONI 46

#snap4city  
#km4city  
#disitlab  
@snap4city

# Public Spaces as Critical Infrastructures

- The City is a system of systems for city users
  - Cascading effects
- **Transport** networks
  - Main means for rescue teams, food, water, etc.
- **Communication**, ICT infrastructure
  - TV cam, switches, cyber,
- **Energy** networks
  - power supply for health, cyber systems, etc.
- **Hospitals** networks
- Aggregation areas



[https://www.snap4city.org/download/video/DPL\\_SNAP4SOLU.pdf](https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf)

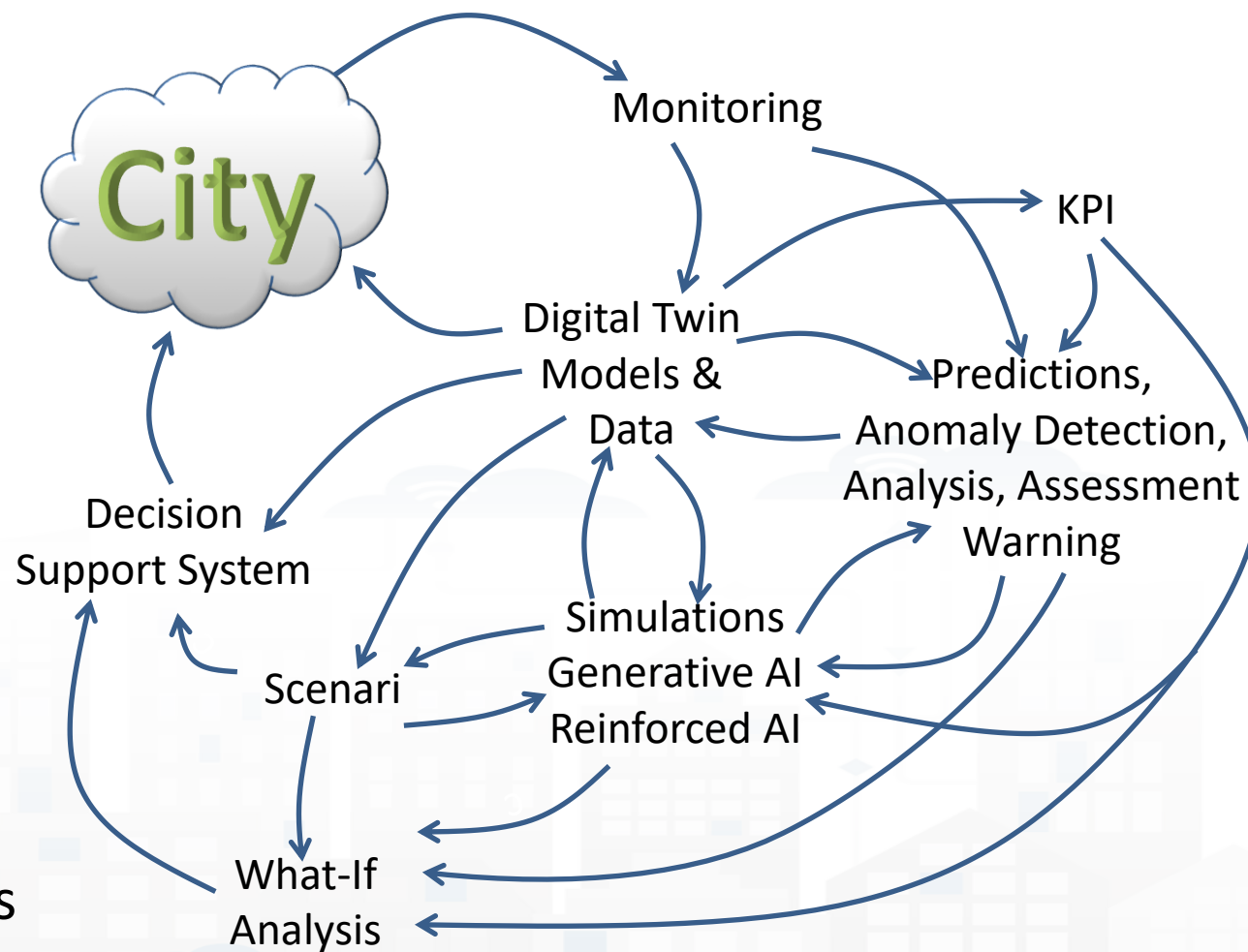


- **Controlling Status: management, and operational**

- Monitoring via KPI
- Computing predictions vs KPI
- Anomaly detection
- Neuro-Symbolic analysis
- Risk assessment
- Early warning on critical conditions

- **Making plan: tactic and strategic, medium and long range, micro/macro**

- Simulation & predictions
- Generative AI Prescriptions, scenarios
- Resilience to Unexpected unknowns
- What-if analysis wrt scenarios

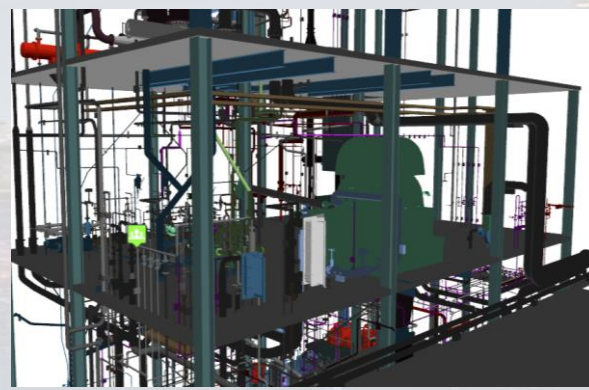
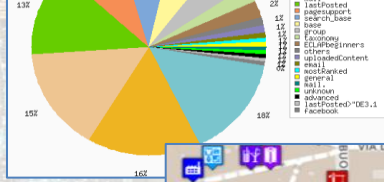
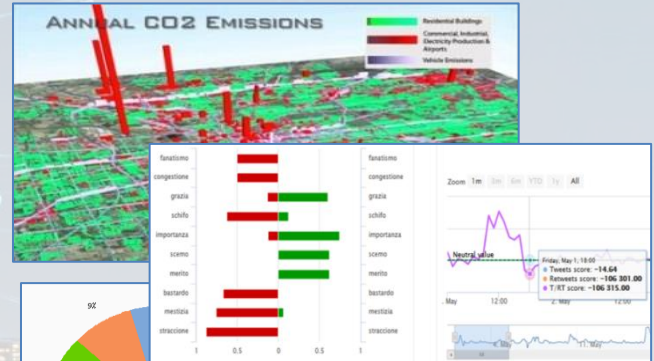
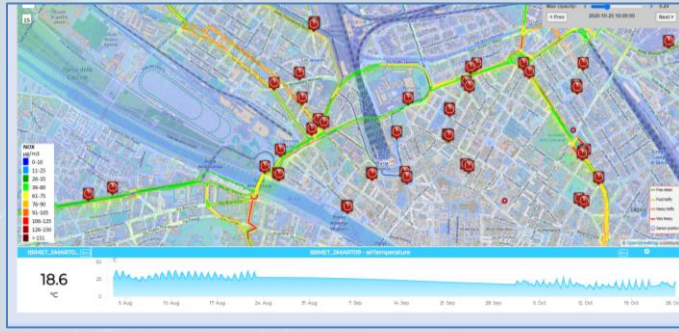




# Digital Twin

## Digital Twin

- **Connected** with real systems
  - **Modelling** aspects: structural, visual, informative, real time data sensors (context), POI, functional, resources, etc.
  - **Analytics:** AI/XAI techniques, simulations, users' needs, etc.
- **Easier to understand the context, review from multiple points of view**
  - **Useful to perform**
    - Discussion with city users
    - Support decision makers
    - By Case Experiments for analysing
      - New solutions, impact of disaster (natural and provoked)
      - Reduction of costs in the analysis, in reduction of mistakes

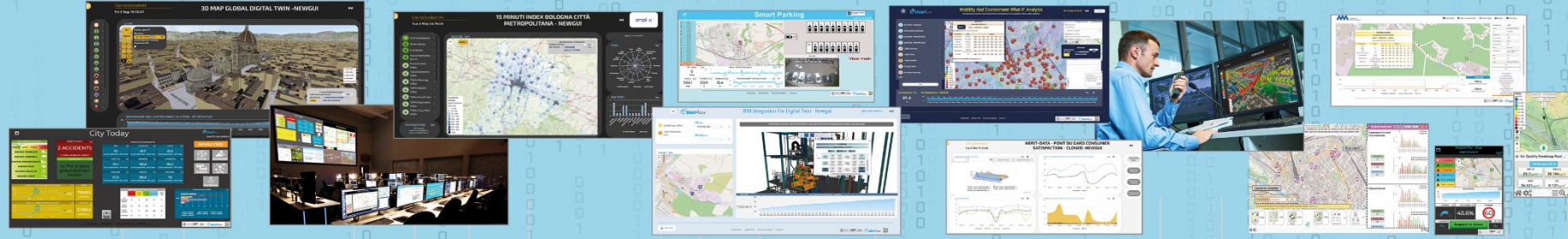




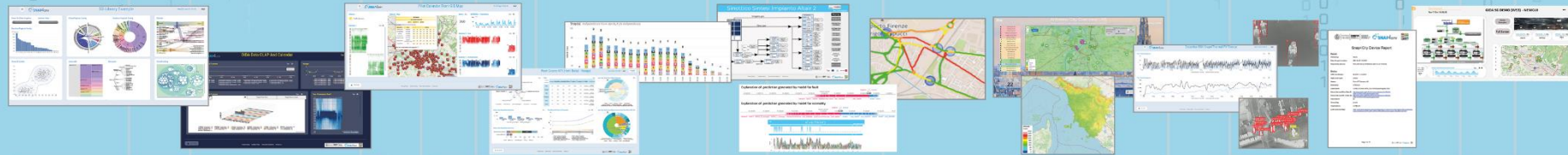


# Smart Solutions and Decision Support Systems

CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - BUSINESS INTELLIGENCE - SIMULATIONS - SMART APPLICATIONS



DASHBOARDS - VISUAL ANALYTICS - SYNOPTICS - DIGITAL TWIN - GRAPHICAL WIDGETS - ANALYTICS - GUI CUSTOM STYLES - VISUAL PROGRAMMING



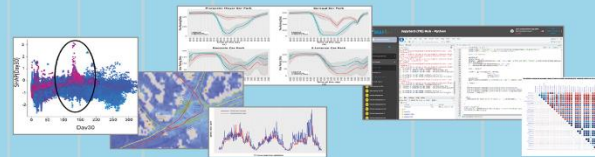
DASHBOARDS, WIDGETS  
TEMPLATES

PREDICTION - ANOMALY DETECTION - CLUSTERING - ROUTING - SENTIMENT NLP - TRAFFIC FLOW  
PEOPLE FLOWS - SDG - 15 MIN CITY INDEX - KPI - HEATMAPS - ORIGIN DESTINATION - ETC...

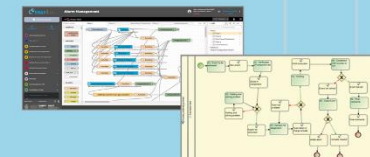
API - MICROSERVICES - GIS - BPM  
VIDEO - REPORTS - MAPS - 3D ...

ANY: DATA, BROKER, NETWORK AND VERTICAL

EXPERT SYSTEM, KNOWLEDGE BASE  
SEMANTIC REASONING  
SMART DATA MODEL  
IOT DEVICE MODELS, STORAGE



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



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

Native and External  
Smart Applications

Mobility & Transport

Light & Energy

Waste

Environment

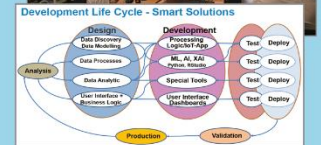
Building

Tourism

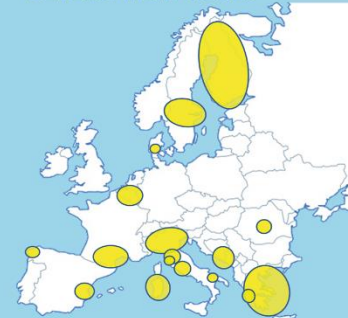
Asset Management

Security and Safety

Social Media



METHODOLOGIES  
LIVING LABS  
COURSES AND COMMUNITY  
DEVELOPMENT TOOLS



Powered by  
FIWARE

FREE  
TRIAL

PEN Test  
Passed

EU GDPR  
COMPLIANT

SNAP4  
Appliances and Dockers  
Installations

EUROPEAN OPEN  
SCIENCE CLOUD

Node-RED

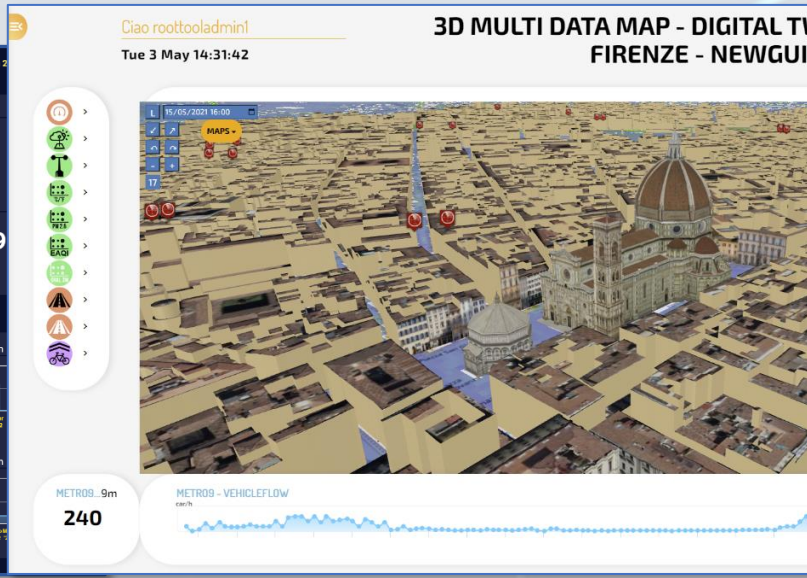
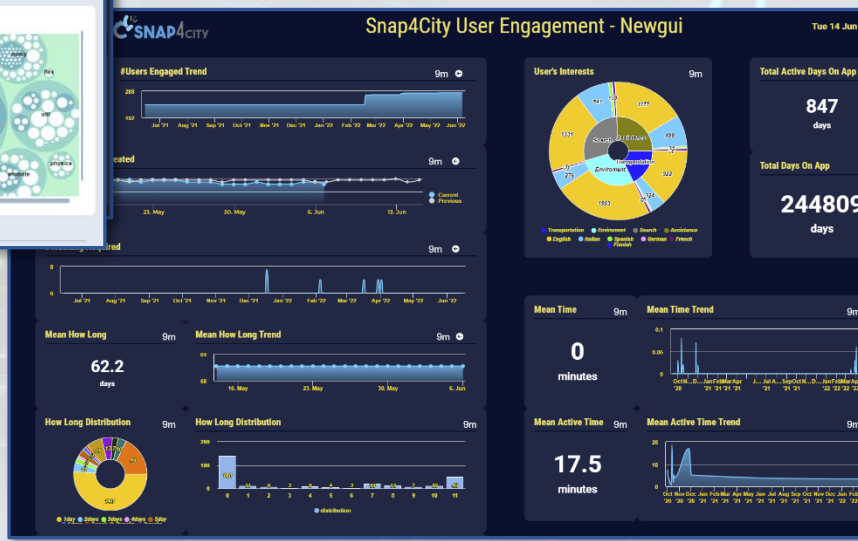
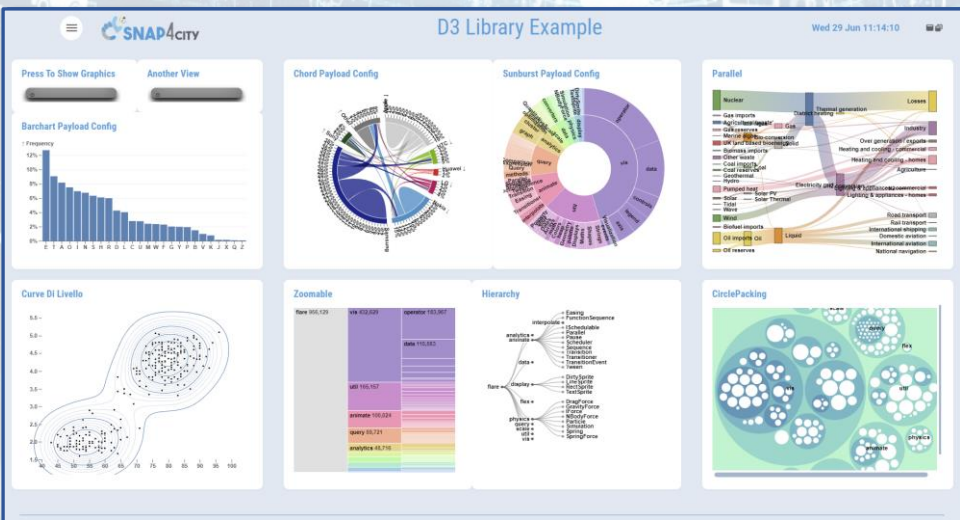
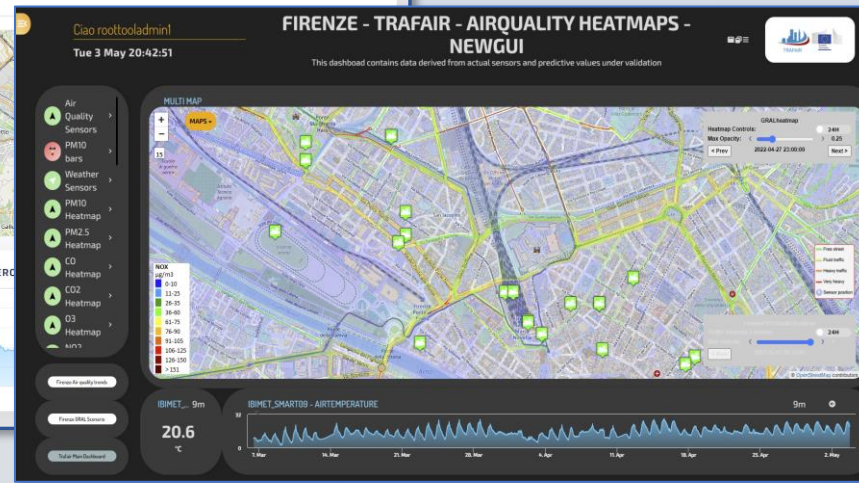
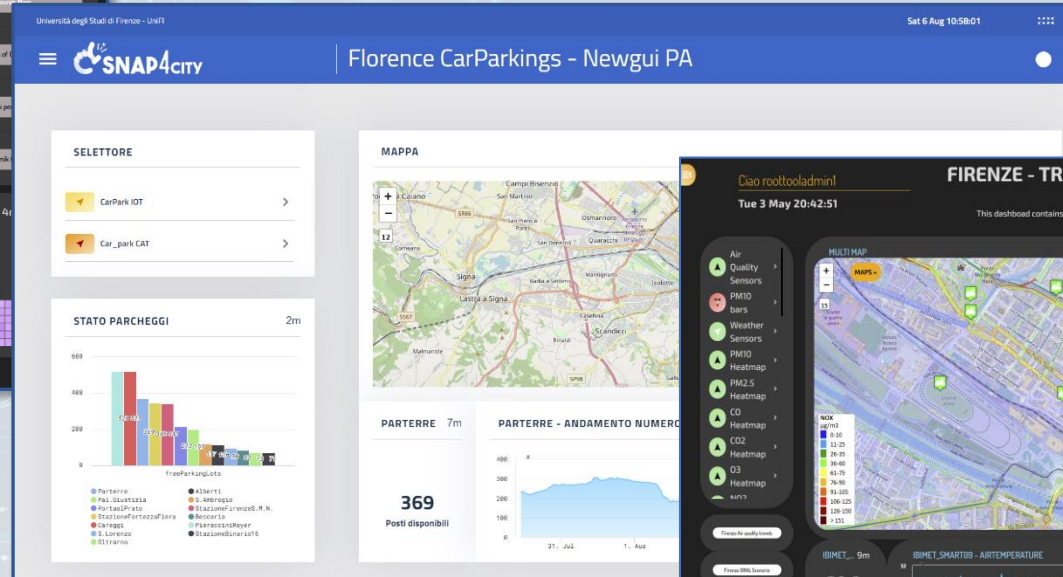
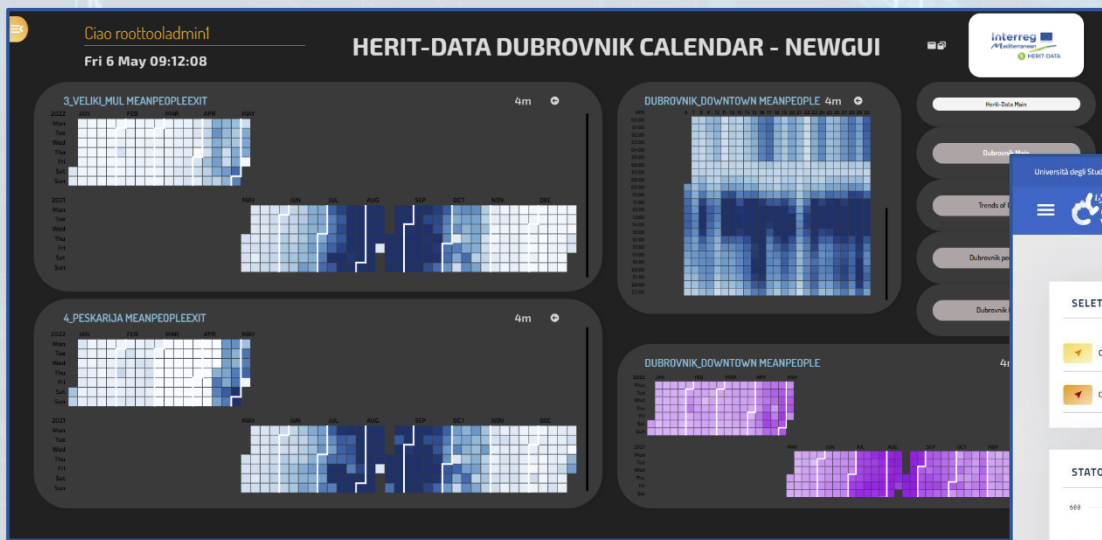
JS Foundation

E015  
digital ecosystem

NVIDIA



# Different Themes



New styles/themes can be developed by specializing a few files from open source

<https://www.snap4city.org/793>



TOP

# Monitoring and Control

FORGING & MANAGING OPEN AND SCALABLE INTER-APPLICATIONS

IoT APPLICATIONS VS IoT EDGE DEVICES

SNAP4CITY BEGINNING

SNAP4CITY ARCHITECTURE DESIGN ECOSYSTEM. OPEN TO DEVELOPERS AND STAKEHOLDERS

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

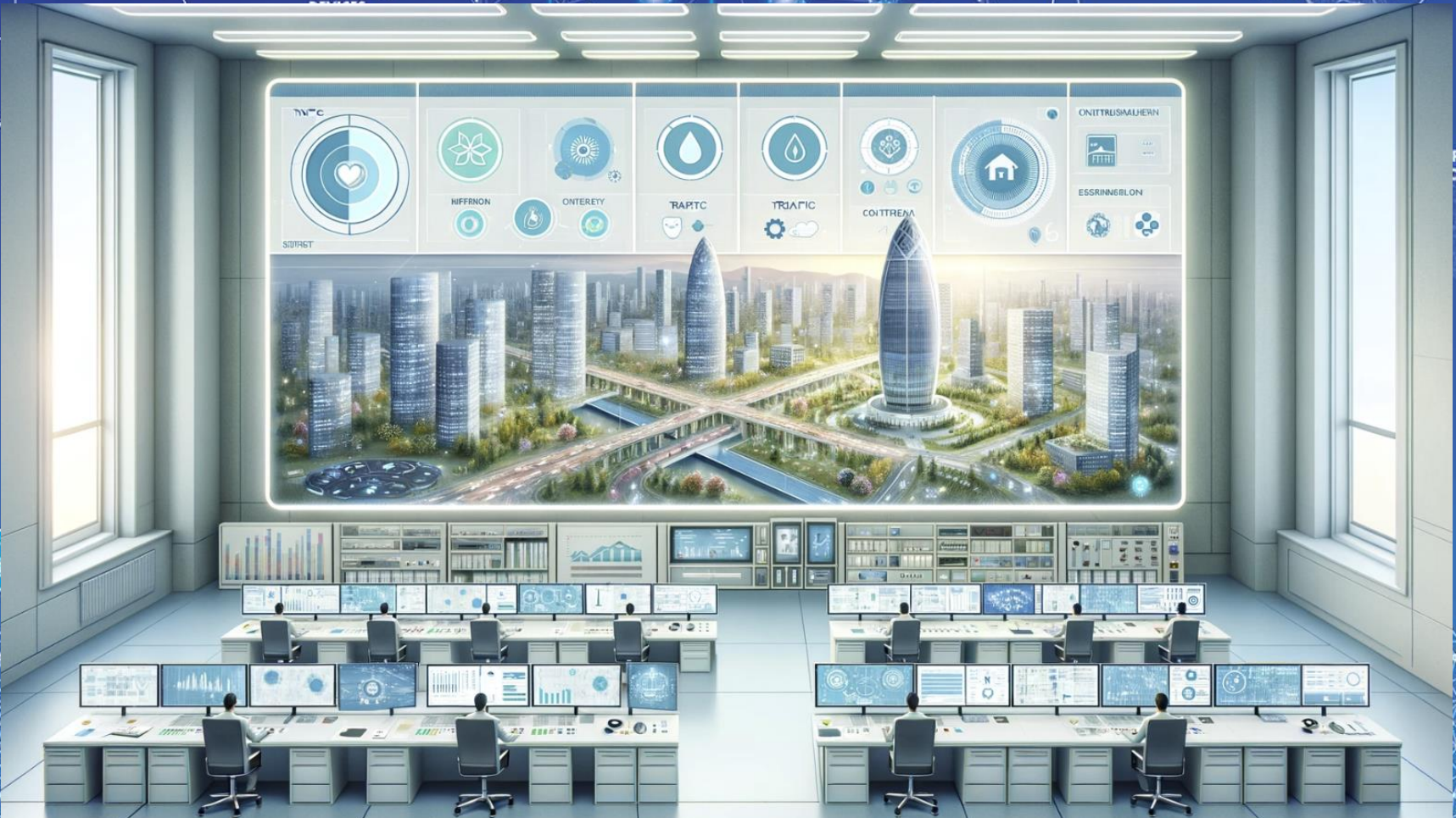
SNAP4CITY AND KM4CITY PROJECTS

FROM CITY DASHBOARD TO APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

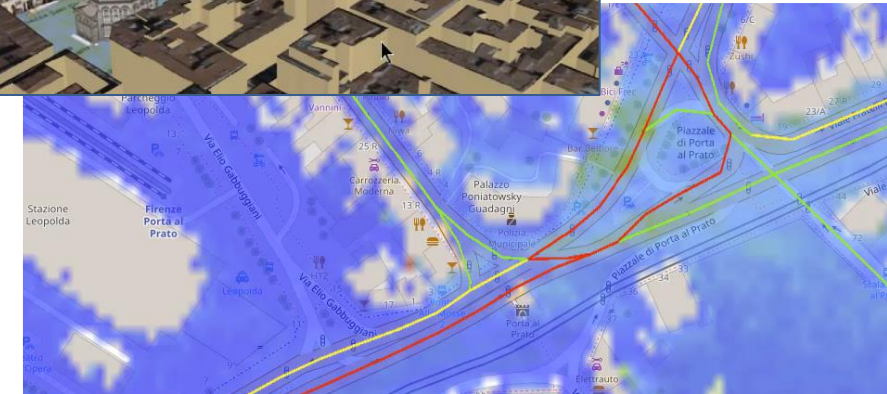
HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

SNAP4CITY THE VIEW OF THE ADMINISTRATORS





- **Controlling Status: management, and operational**
  - Monitoring via KPI
  - Computing predictions and KPI
  - Anomaly detection, Early warning
  - Control Rooms, situation rooms
- **Reacting: Computing in real time**
  - Changing semaphore maps
  - Changing Dynamic signage
  - Real time Info Mobility
  - User engagement via Mobile Apps
  - What-if analysis
  - etc.,





# Smart City Control Room Florence Metropolitan City



reference



## • Multiple Domain Data

- 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



<https://www.snap4city.org/747>





# Key Performance Indicators, KPI



- **United Nations Sustainable Development Goals, SDGs** (for which cities can do more to achieve some of the 17 SDGs, <https://sdgs.un.org/goals>);
- **15 minutes cities** (where primary services must be accessible within 15 minutes on foot);
- **objectives of the European Commission** in terms of pollutant emissions for: NO2, PM10, PM2.5 ([https://environment.ec.europa.eu/topics/air\\_en](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.

Global  
&  
Local  
  
Periodic  
&  
Realtime

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





# 15MinCityIndex on Bologna

Ciao roottooladmin!

Tue 3 May 20:14:59

## 15 MINUTI INDEX BOLOGNA CITTÀ METROPOLITANA - NEWGUI

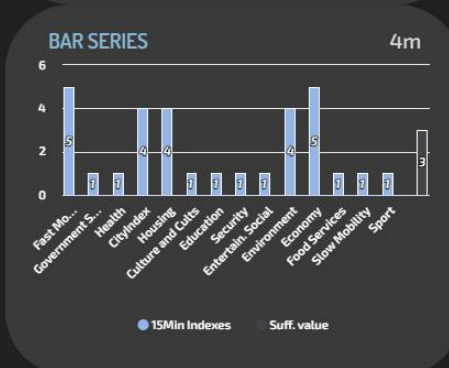
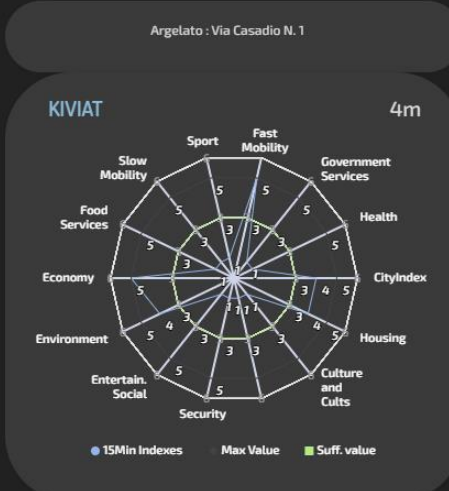
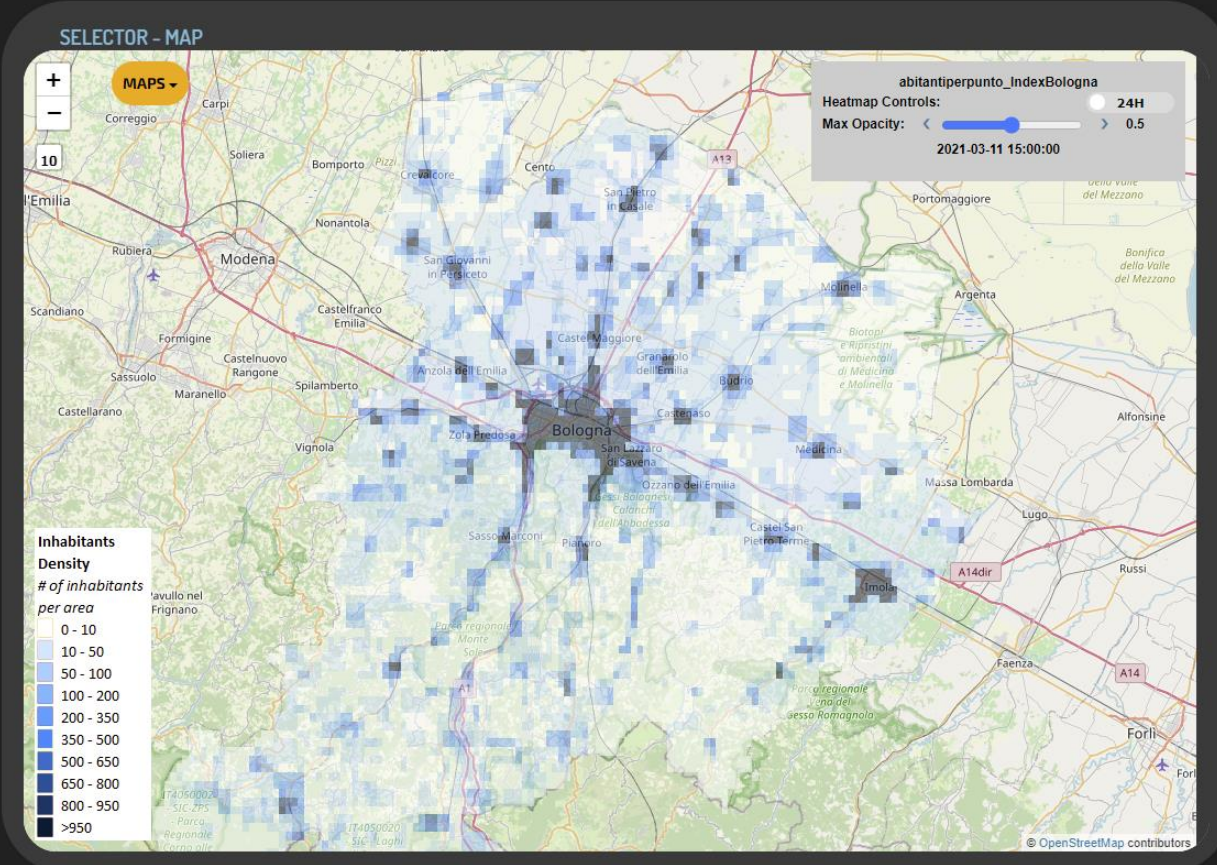


enel x

- # of Inhabitants >
- Green factor >
- Civil factor >
- Industrialization factor >
- Environment Index >
- 15Min Economy Index >
- 15Min Housing Index >
- 15Min Health Index >
- 15Min Food Index >
- 15Min Education Index >
- 15Min Slow Mob Index >

THE PICKED POINT 9m

City: Argelato  
Address: Via Casadio N. 1  
Lat,lon: 44.61882,11.35437



**1** NO POVERTY

**2** ZERO HUNGER

**3** GOOD HEALTH AND WELL-BEING

**4** QUALITY EDUCATION

**7** AFFORDABLE AND CLEAN ENERGY

**9** INDUSTRY, INNOVATION AND INFRASTRUCTURE

**11** SUSTAINABLE CITIES AND COMMUNITIES

**12** RESPONSIBLE CONSUMPTION AND PRODUCTION

**13** CLIMATE ACTION

**15** LIFE ON LAND



# Decision Support System:

# Immediate response and Tactical and Strategic Plans, via What-if Analysis

FORGING & MANAGING OPEN ARCHITECTURE AND ECOSYSTEMS

IOT APPLICATIONS AND DEVICES

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM, OPENED TO DEVELOPERS AND STAKEHOLDERS

SNAP4CITY AND KM4CITY PROJECTS

FROM CITY DASHBOARD TO APPLICATIONS



NAP4CITY THE VIEW OF THE ADMINISTRATORS







Ciao roottooladmin!

Fri 2 Sep 19:13:07

## 3D MAP GLOBAL DIGITAL TWIN - NEWGUI



3D MAP

The 3D map interface includes a settings panel on the left with the following options:

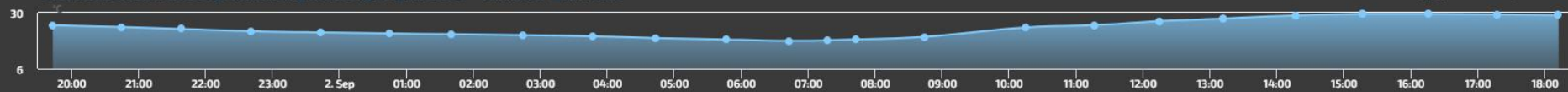
- Enable Lights
- Datetime: 02/08/2022 10:11
- Enable dynamic shadows (experimental)

A legend on the right side of the map defines traffic levels:

- Free street
- Fluid traffic
- Heavy traffic
- Very heavy
- Sensor position

At the bottom right, there is a traffic heatmap control for "FirenzeFIPILITrafficRealtime" with a 24H duration and a Max Opacity slider set to 1. The timestamp is 2022-09-02 18:56:00.

DISIT:ORIONUNIFI:TUSC\_WEATHER\_SENSOR\_OW\_3176959 - AIRTEMPERATURE





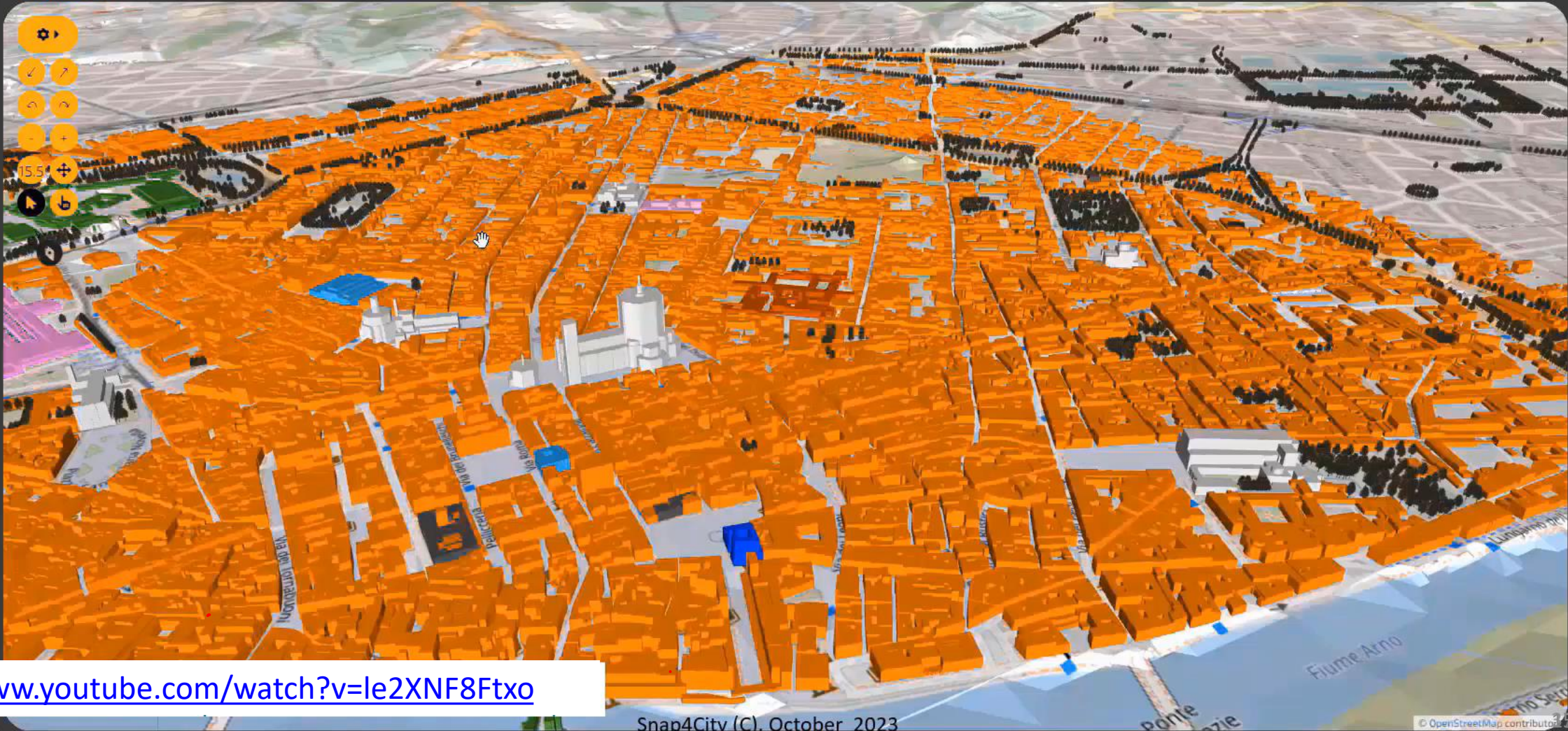
Ciao

Fri 13 Oct 18:29:18

# FLORENCE SCDT

DOUBLE MAP

- SELECT...
- GRAL HD
  - NO 2
  - 
  - 
  - 
  - 
  - 
  - 
  - WHAT-IF
  - 
  -



<https://www.youtube.com/watch?v=le2XNF8Ftxo>



TOP

# Data Analytic Artificial Intelligence, XAI, Machine and Deep Learning

FROM CITY DASHBOARD TO APPLICATIONS

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

IoT APPLICATIONS VS IoT EDGE DEVICES

SNAP4CITY FOR BUSINESS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND STAKEHOLDERS

TWITTER VIGILANCE: SOCIAL MEDIA ANALYSIS

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DATA ANALYTICS: INTELLIGENCE, WHAT-IF AND SIMULATION

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DECISION SUPPORT SYSTEM AND CITY RESILIENCE

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

APPLICATIONS LOGIC AND PARTNERSHIP

ADVANCED SMART CITY AND MICRO-SERVICE SNAP4CITY

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK







# Available AI Solutions on Snap4City

- **Mobility and Transport**
- **Environment, Weather, Waste, Water**
- **City Users Behaviour and Social analysis**
- **Energy and Control, Security, .....**
- **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/DPL\\_SNAP4SOLU.pdf](https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf)

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





- **15 Minute City Index:**
  - 13 subindexes: energy, slow mobility, fast mobility, housing, economy education, culture and cults, health, entertainment, gov, food, security...



- Monitoring and Prediction of energy consumption
- Stimulating: Bike sharing, e-bikes, car charge, etc.



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



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



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



- Monitoring and Predicting: NO<sub>2</sub>, NO<sub>x</sub>, CO<sub>2</sub>, Traffic flow, pollutant, landslide, waste, etc
- Traffic flow reconstruction
- Demand vs Offer of Mobility analysis



- Shortening justice time
- Anonymization and indexing legal docs.
- Prediction of mediation proneness
- Ethical Explainable Artificial Intelligence





# Mobility & Transport

FROM CITY DASHBOARD TO APPLICATIONS  
AND FLEXIBLE WEB  
AND MOBILE APPS

SNAP4CITY FOR  
BEGINNERS

SNAP4CITY

TWITTER  
VIGILANCE SOCIAL  
MEDIA ANALYSIS

SNAP4CITY  
AND KM4CITY  
PROJECTS

HOW TO ADOPT  
SNAP4CITY, AND  
OUR ROADMAP

SNAP4CITY THE  
VIEW OF THE  
ADMINISTRATORS

FROM CITY  
DASHBOARD TO  
APPLICATIONS

DATA C  
AND C  
KNOW  
MANA





# For example:

Select map

Zoom

New Scenario

Editing

Drag & drop

Split & Join

Delete

Do and Undo

Scenario name:

Location:

Scenario description:

ReferenceKB:

Save Road Graph:  Yes

Save traffic Sensors:  Yes

Save other Sensors:  Yes

From:

To:

Save

Category Street:

Nr.Lanes:

Speed Limit (km/h):

Direction:

Restrictions:

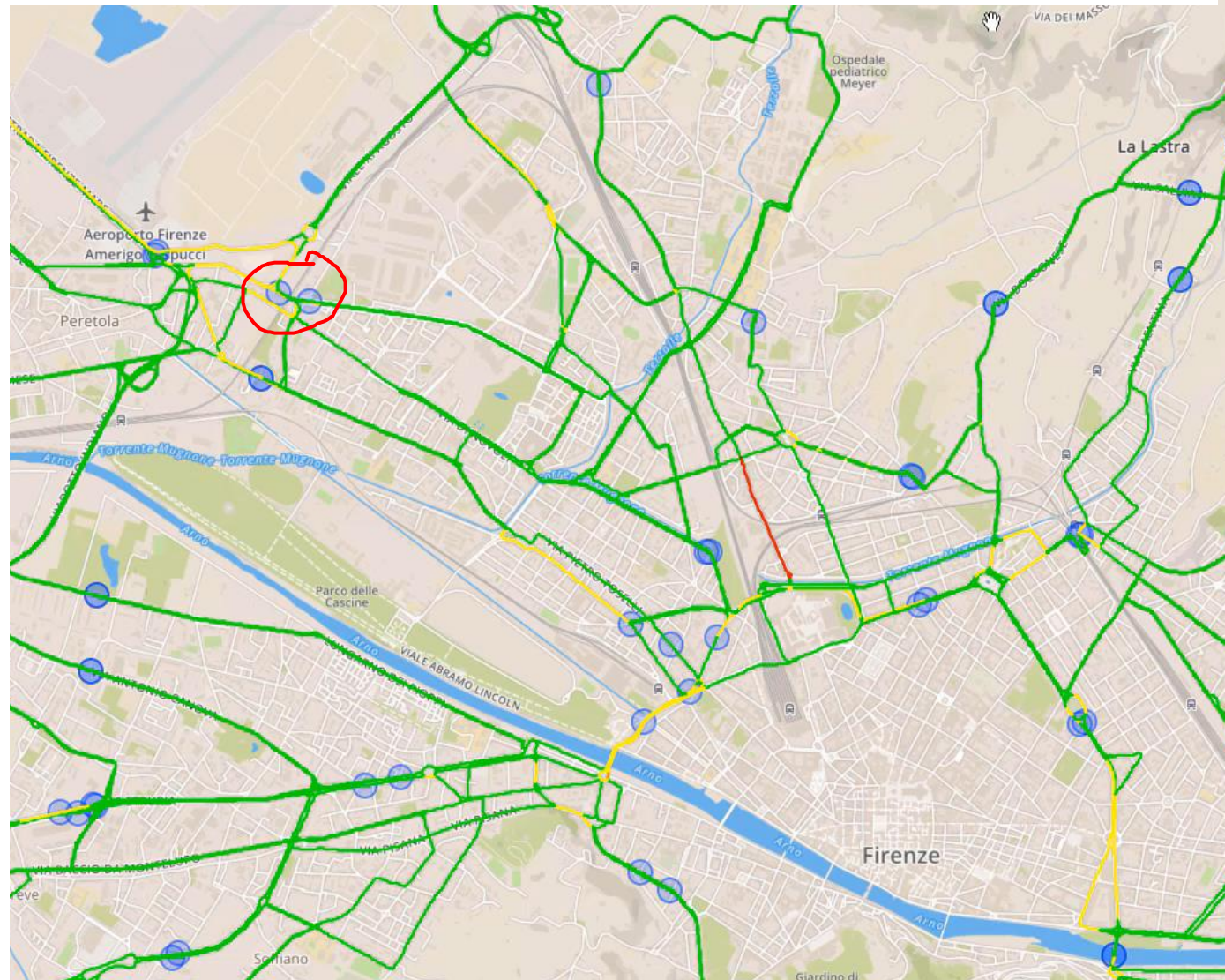
Edit Road Segment

identifier
composition
elemLocation
elementClass
elementType
length
operatingStatus
speedLimit
trafficDir
width
highwayType
route



# Dense Traffic Flow Reconstruction ?

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





# Decision Support Systems, What-if

## ○ Event planning, via what-if analysis

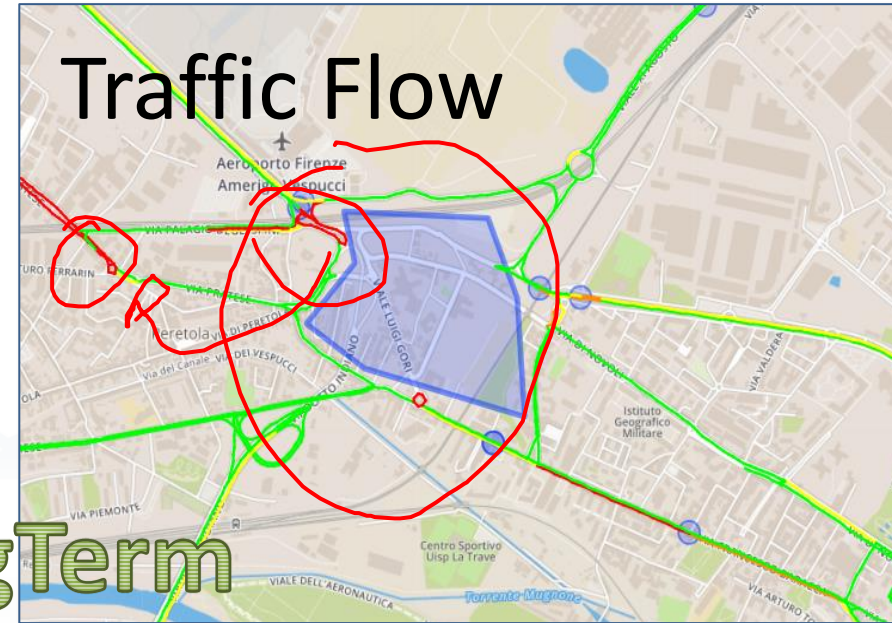
- Change in the graph structure of the city
- Impact on the flow of people and vehicles
- Adaptation: public transport, traffic, pedestrian management, etc.

## ○ Immediate reaction to natural events or not

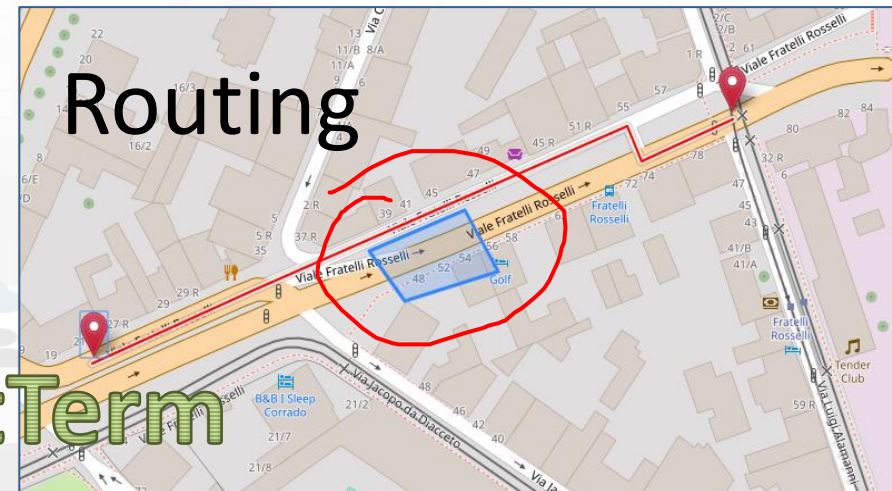
- Everything is ready and updated in real time
- Each view is contextualized in terms of data: descriptive and prescriptive

## ○ 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



LongTerm



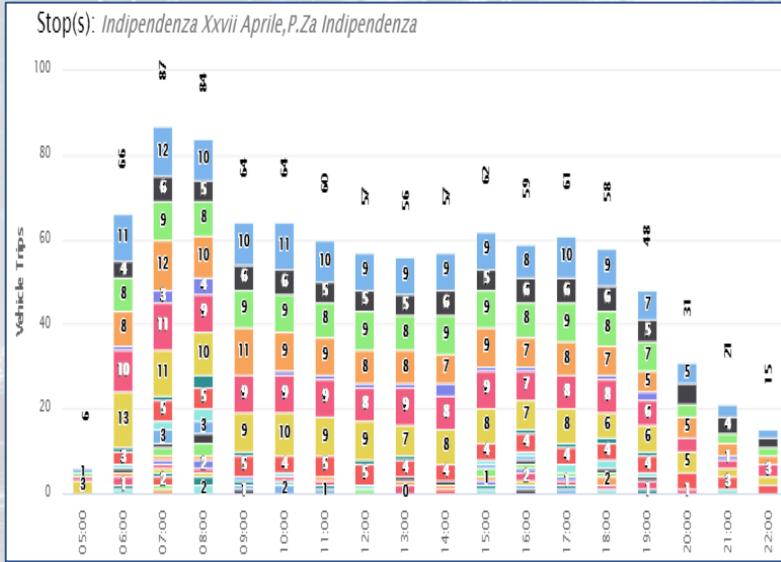
ShortTerm



# What-if Analysis on Pub Transport

- Definition of scenarious impact on
  - Traffic, Pollutant, parking, public transport, private flows, etc.
  - KPI analysis

## Public Services



Welcome to DORAM powered by SNAP4CITY

Services: 36 on 36 available

The public transportation system has been analyzed in the City, considering the service offer vs. mobility demand. The top-thirty most crowded stops are presented on the right panel and on the map. Please, select your desired scenarios or a stop on the map to perform other analysis.

Type the stop name ... Search

Stop panel

Scenario Selector

Choose a scenario: Actual scenario

Actual scenario: Describes the current status of the public transportation network. (More Info)

Daily Individual Trips > 52000  
 Stops > 1900  
 Residential Buildings > 31000  
 Service Providers > 32000  
 Mobility Operators > 10  
 Transport Modes = 3

**The Most Crowded Stops**

Select a time slot: 05:00 to 01:59 Search

**Indipendenza Xxvii Aprile**  
**P.Za Indipendenza**

Daily Pick-ups: 377  
 Daily Drop-offs: 407  
 Daily Vehicle Trips: 979

**Stazione Nazionale**

Daily Pick-ups: 321  
 Daily Drop-offs: 358  
 Daily Vehicle Trips: [unlabeled]



# Snap4ISPRRA Parking: ISPRRA JRC

## Parking 58C

Fri 6 Oct 18:33:41

A1_1	A1_2	A1_3	A1_4	A1_5	A1_6	A1_7	A1_8	A1_9	A1_10	A1_11	A1_12	A1_13	A1_14	A1_15	A1_16	A1_17	A1_18	A1_19	A1_20	A1_21	A1_22	A1_23	A1_24	A1_25	A1_26	A1_27	A1_28	A1_29	A1_30	A1_31	A1_32	A1_33	A1_34	A1_35	A1_36	A1_37	A1_38	A1_39	A1_40	A1_41	A1_42	A1_43	A1_44	A1_45	A1_46	A1_47	A1_48	A1_49	A1_50	A1_51	A1_52	A1_53	A1_54	A1_55	A1_56	A1_57	A1_58	A1_59	A1_60	A1_61	A1_62	A1_63	A1_64	A1_65	A1_66	A1_67	A1_68	A1_69	A1_70	A1_71	A1_72	A1_73	A1_74	A1_75	A1_76	A1_77	A1_78	A1_79	A1_80	A1_81	A1_82	A1_83	A1_84	A1_85
------	------	------	------	------	------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Capacity: 9m, Free Slots: 9m, Occupancy: 12.9%  
Overparking Slots: 0# (circled in red), Unknown State Slots: 3#

### Time Trend Comparison

### Free Slots Weekly Time Trend Compare

### Percentage Of Occupancy Daily Time Trend Comparison

### Overparking Weekly Time Trend Compare



# Smart Energy / Building

TWITTER  
VIGILANCE SOCIAL  
MEDIA ANALYSIS

FROM CITY  
DASHBOARD TO  
APPLICATIONS

DATA  
ANALYTICS  
MANAGEMENT



100%  
OPEN  
SOURCE





Capelon Cabinet (iot-search)

Ac...9m ActualState0Count - St... 9m

12

Radar Series

4m

Selector - Map

:CCabinet\_9ee9e983-E4fb-33c9-9562-2d99cb48a4fa - Burni...9m

Time Trend

4m

- CAPELON:orionCAPELON-UNIFI:CCabinet\_9ee9e983-e4fb-33c9-9562-2d99cb48a4fa - phase...
- CAPELON:orionCAPELON-UNIFI:CCabinet\_9ee9e983-e4fb-33c9-9562-2d99cb48a4fa - phase...
- CAPELON:orionCAPELON-UNIFI:CCabinet\_9ee9e983-e4fb-33c9-9562-2d99cb48a4fa - phase...

My Profile

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Tin

Elenco lampade Visualizzazione dati Log eventi Grafici Impostazioni

N. Punto Luce	11307
DevEui	7083D58F100085D7
Via	RomStraÙe
Regolazione	
Ore di servizio	
Conta energia	
Potenza attuale	
Stato	Inattivo
Nome errore	null
RSSI	
SNR	
Data	01/11/2023 12:01:18

Regolazione

Stato Linea

Non Attivo  
Stato Linea verso Sinigo

Non Attivo  
Stato Linea verso Merano Centro

# Smart Light Management

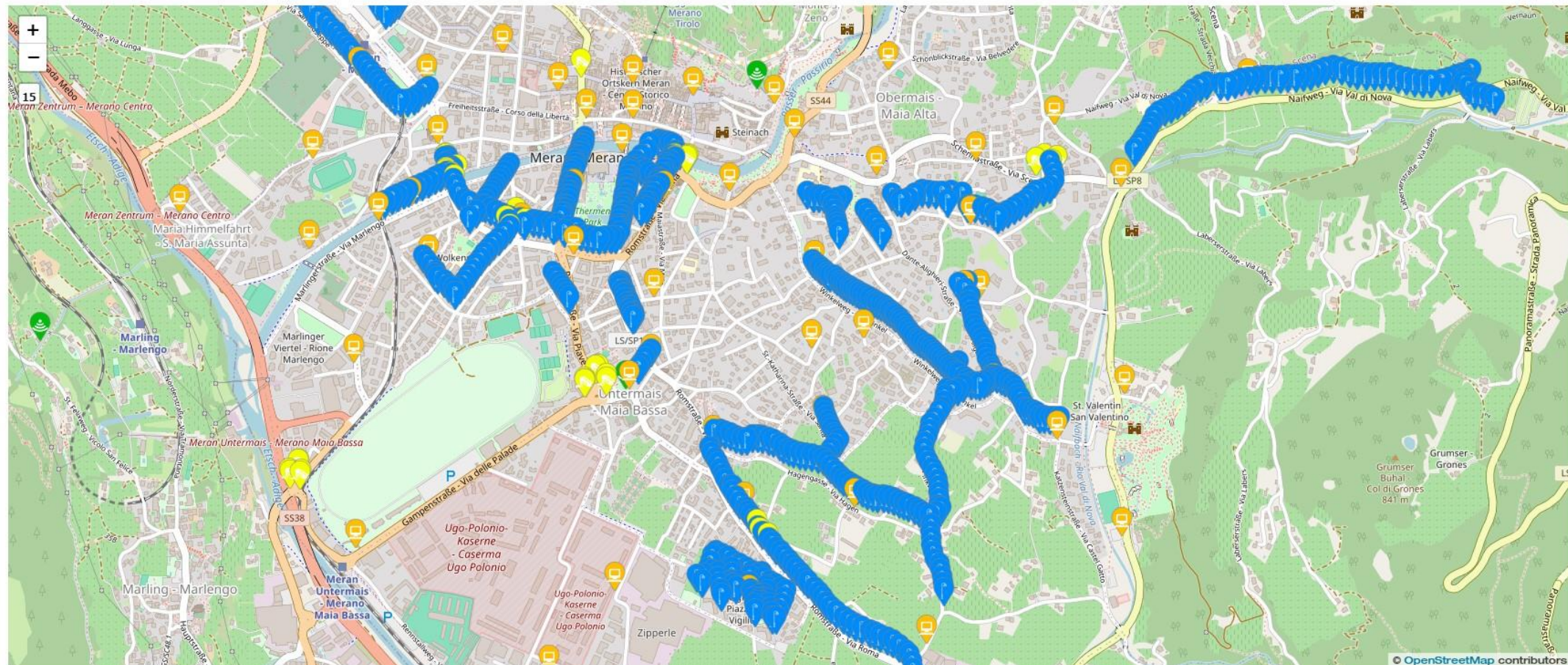


# Smart Light in Merano



## Merano - tutti i servizi

Wed 13 Dec 15:34:57

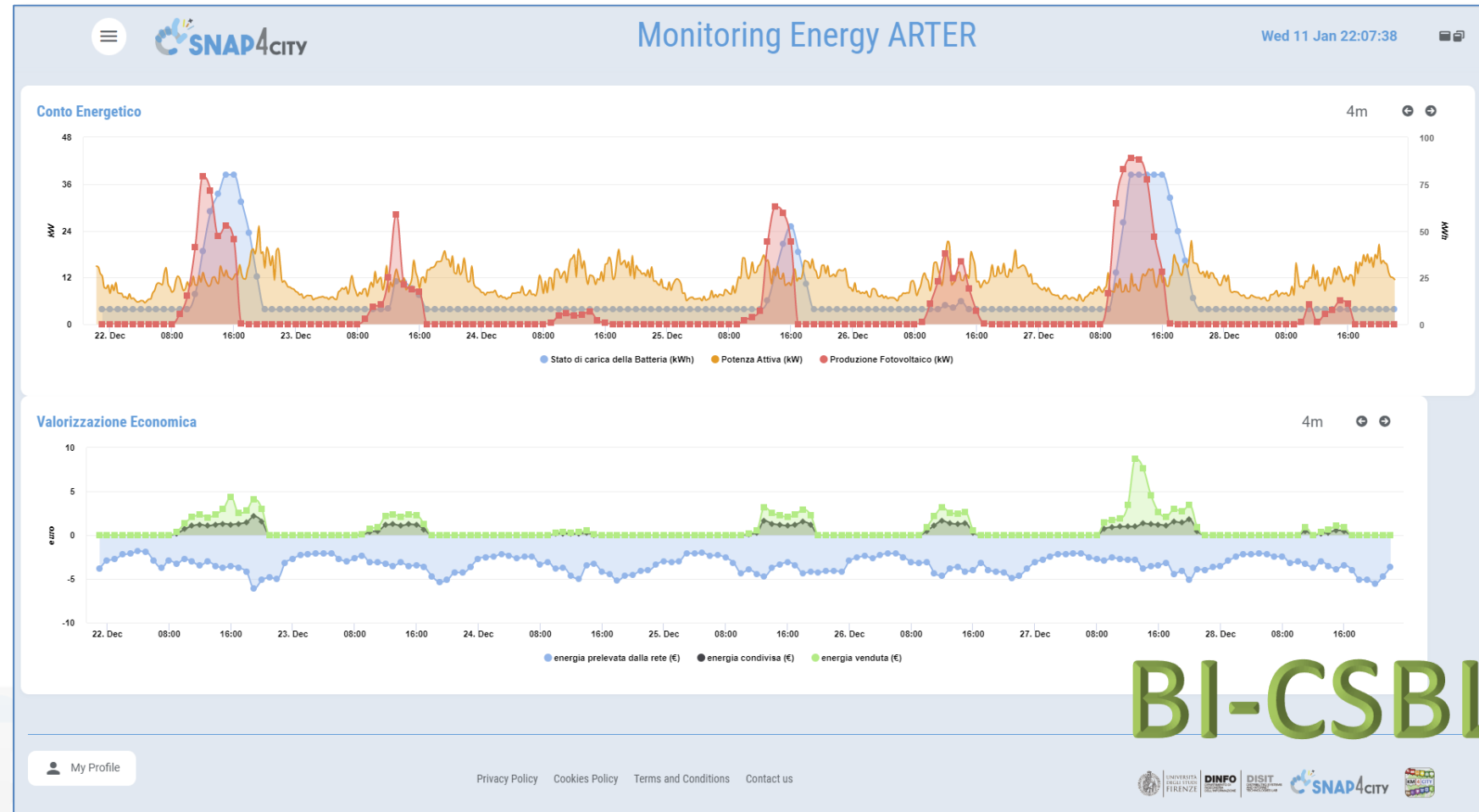


© OpenStreetMap contributors





- **Field-tested energy community: the self-consumer 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



BI-CSBL

<https://www.selfuser.it>



<https://www.snap4city.org/dashboardSmartCity/view/Baloon.php?iddashboard=MzczNg==>

Ciao roottooladmin!

Sat 11 Nov 17:26:28

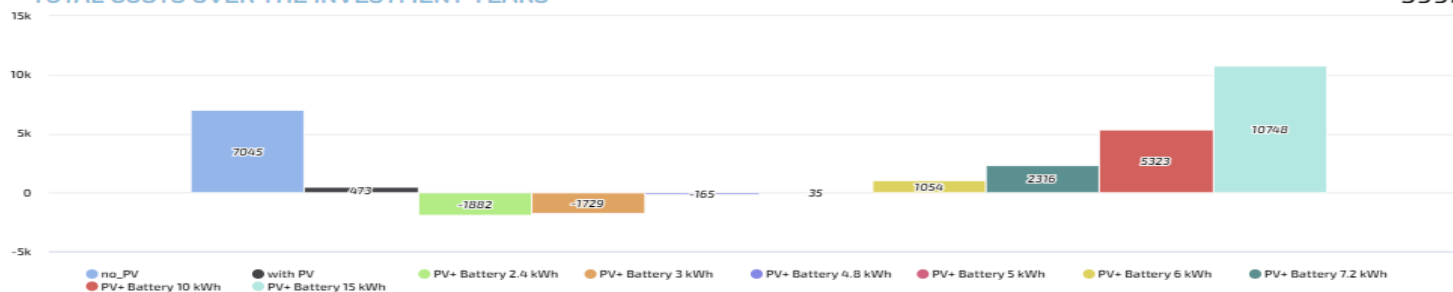
## ONLINE PHOTOVOLTAIC SYSTEM SIMULATOR

User Manual

Italian Version

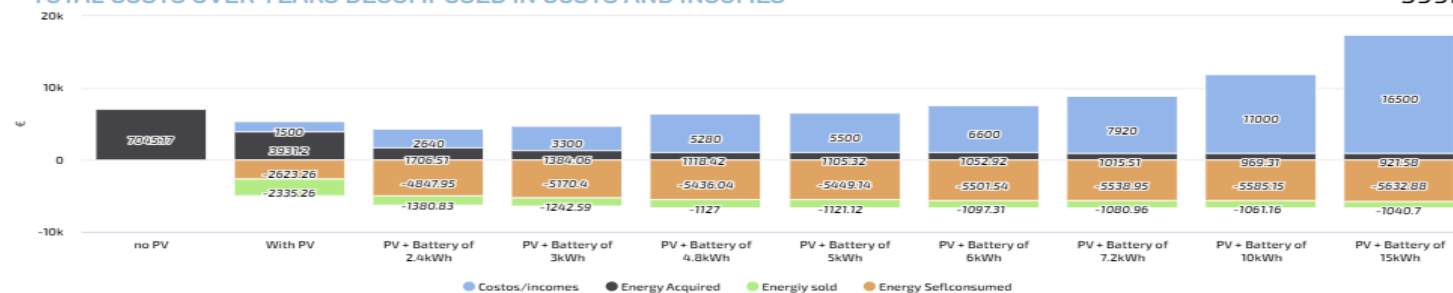
### TOTAL COSTS OVER THE INVESTMENT YEARS

599m



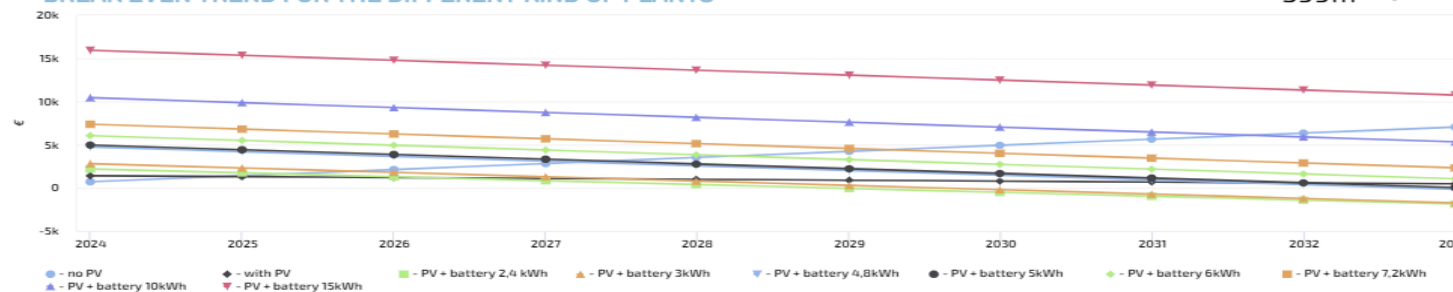
### TOTAL COSTS OVER YEARS DECOMPOSED IN COSTS AND INCOMES

599m



### BREAK EVEN TREND FOR THE DIFFERENT KIND OF PLANTS

599m



### PARAMETERS OF YOUR PV PLANT

We suggest you PV plus battery of 2.4 kWh

Annual Consumption

Price of energy sold (€/kWh)

Price of Energy Acquired (€/kWh)

Years of Investment

Months for typical trends

Compute



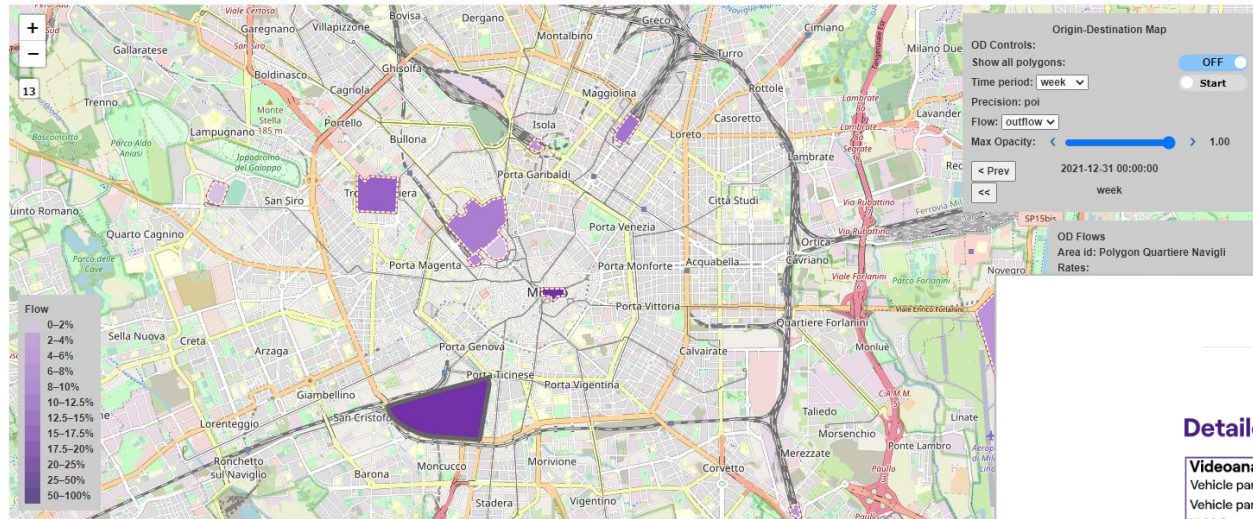


# Energy monitoring and business intelligence

## Green and Data Driven District

Aggregated KPI JuicePark SmartPole CityAnalytics

POI - OD POI - PRESENZE POI - PRESENZE (TS) ACE - PRESENZE ACE - PRESENZE (TS)



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## Green and Data Driven District

Aggregated KPI JuicePark SmartPole CityAnalytics

### Detailed KPIs

#### Videoanalysis

People counted daily:

People counted to date:

People aggregation daily:

People aggregation to date:

Vehicle counted daily:

Vehicle counted to date:

#### Power meter

Daily energy consumed:

Energy consumed to date:

Daily energy produced:

Energy produced to date:

#### WiFi

Max number of connected devices in the last day:

Hourly average connected devices:

#### eBike

Daily number of sessions:

Number of sessions to date:

Total Energy consumed:

Average energy consumed:

Last charger session:

#### Emergency

SOS requests to date:

SOS request daily:

AED requests to date:

AED requests to daily:

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## Green and Data Driven District

Aggregated KPI JuicePark SmartPole CityAnalytics

### Detailed KPIs

#### Videoanalysis

Vehicle parked daily:

Vehicle parked to date:

Vehicle count daily:

Vehicle count to date:

#### Power meter

Energy consumed daily:

Energy consumed to date:

Energy produced daily:

Energy produced to date:

#### WiFi

Max number of connected devices in the last day:

Hourly average connected devices:

#### Emergency

SOS Requests to date:

SOS request daily:

#### EV charged

Number of sessions daily:

Number of sessions to date:

Total Energy consumed:

Average energy consumed:

Last charger session:

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7 AFFORDABLE AND CLEAN ENERGY



11 SUSTAINABLE CITIES AND COMMUNITIES





# Cuneo Assets' Monitoring, Safety



☰ SNAP4
Monitoraggio Generale
Thu 4 Jan 18:13:19

- ▶ CameraModelP1448-LE
- ▶ UpsModelRiello
- ▶ UpsModelSeltec
- ▶ SwitchModelMicrosense
- ▶ SwitchModelNetonix

**Legenda**

GENERAL STATUS		
Valore	Significato	Simbolo
0	Buono stato	●
1	Non raggiungibile	●
2	Raggiungibile, dati non disponibili	●
3	Identificata anomalia	●

▲ TempValu... 9m

49

▲ TempValue1 - 7 Days

☰ SNAP4
Monitoraggio Dettagliato
Thu 4 Jan 18:05:15

**Tabella Device**

🔍 Cerca per Indirizzo, ID o device...

Camera UPS Switch
● ● ● ●

ID	Stato	Tipo device	Indirizzo	IP	Azioni
TC010182	●	Camera	Cuneo Sud Palo Angolo Parco Giochi	172.16.12.185	📍
TC010178	●	Camera	Cuneo Sud Palo Alto verso Asilo	172.16.12.181	📍
TC010181	●	Camera	Cuneo Sud Palo davanti Biblioteca	172.16.12.184	📍
TC010179	●	Camera	Biblioteca Cuneo Sud Esterna Sopra Ingresso	172.16.12.182	📍
TC010184	●	Camera	Cuneo Sud Angolo verso Parco Giochi	172.16.12.187	📍
TC010185	●	Camera	Cuneo Sud Angolo verso Bar	172.16.12.188	📍
TC010183	●	Camera	Cuneo Sud Angolo davanti Megafresco	172.16.12.186	📍
TC010203	●	Camera	Rotonda Corso Francia Croce Rossa	172.16.12.203	📍
TC010204	●	Camera	Rotonda Corso Francia Distributore	172.16.12.204	📍
SWITCH041	●	Switch	Rotonda Corso Francia Croce Rossa	172.16.15.222	📍
TC010202	●	Camera	Rotonda Corso Francia Tabaccaio	172.16.12.202	📍
SWITCH040	●	Switch	Rotonda Corso Francia Croce Rossa	172.16.15.223	📍

**SWITCH015**

VALUE NAME: 1721615250

DETAILS DESCRIPTION RT DATA

Last update: 2024-01-04 13:34:24.334Z

Description	Value	Buttons									
dateObserved	01/04/24, 02:34:24 PM	Last	4h	24h	7d	30d	6m	1y	2y	10y	
fanSpeed	4985	Last	4h	24h	7d	30d	6m	1y	2y	10y	
generalStatus	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue1	48	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue10	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue11	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue12	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue13	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue14	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	

**TC010185**

dateObserved	04/01/2024, 14:34
generalStatus	●
tempStatus1	1

**TEMP STATUS**

Valore	Significato
1	Buono stato
2	Letture dato fallita

**Legenda**

● 115
 ● 13
 ● 22
 ● 4
 

Non raggiungibile





# Monitoraggio Generale

Fri 2 Feb 17:08:24

- CameraModelP1448-LE
- UpsModelRiello
- UpsModelSeltec
- SwitchModelMicrosense
- SwitchModelNetonix

**SWITCH027**  
VALUE NAME: 1721615236

DETAILS DESCRIPTION RT DATA

Last update: 2024-02-02 14:05:50 176Z

Description	Value	Buttons									
dateObserved	02/02/24, 03:05:50 PM	Last	4h	24h	7d	30d	6m	1y	2y	10y	
fanSpeed	6165										
generalStatus	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue1	48	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue2	48	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue3	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue4	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue5	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	
poeValue6	0	Last	4h	24h	7d	30d	6m	1y	2y	10y	

**Legenda**

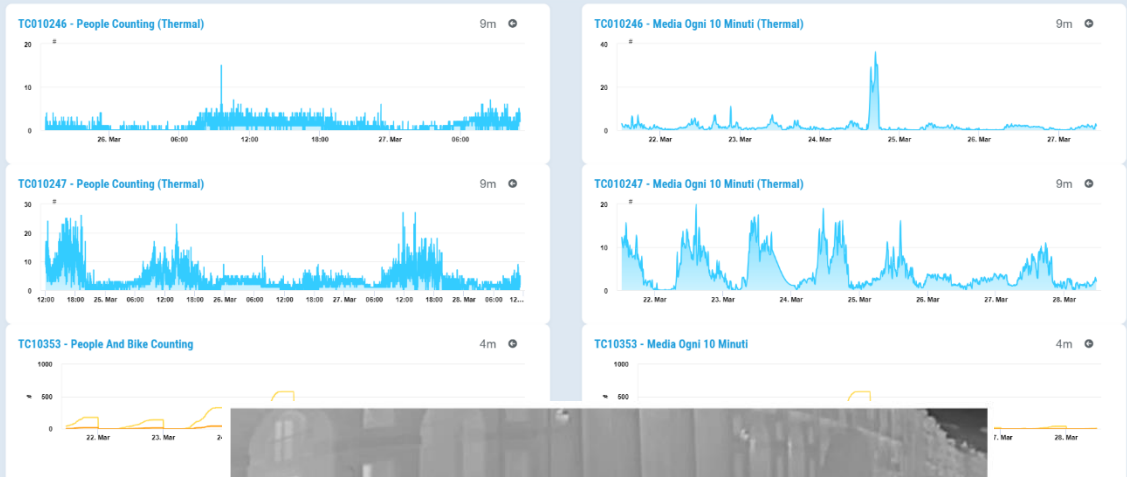
Valore	Significato	Simbolo
0	Buono stato	●
1	Non raggiungibile	●
2	Raggiungibile, dati non disponibili	●
3	Identificata anomalia	●

**Stato Attuale** 9m

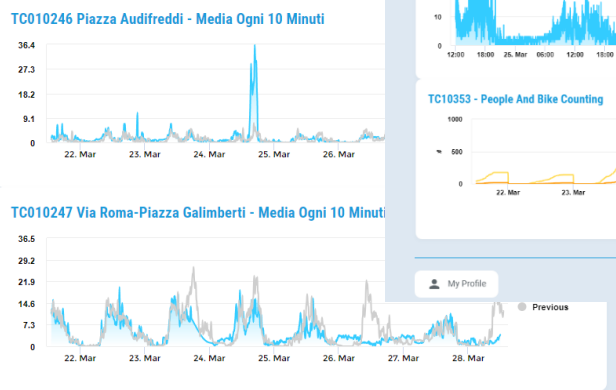
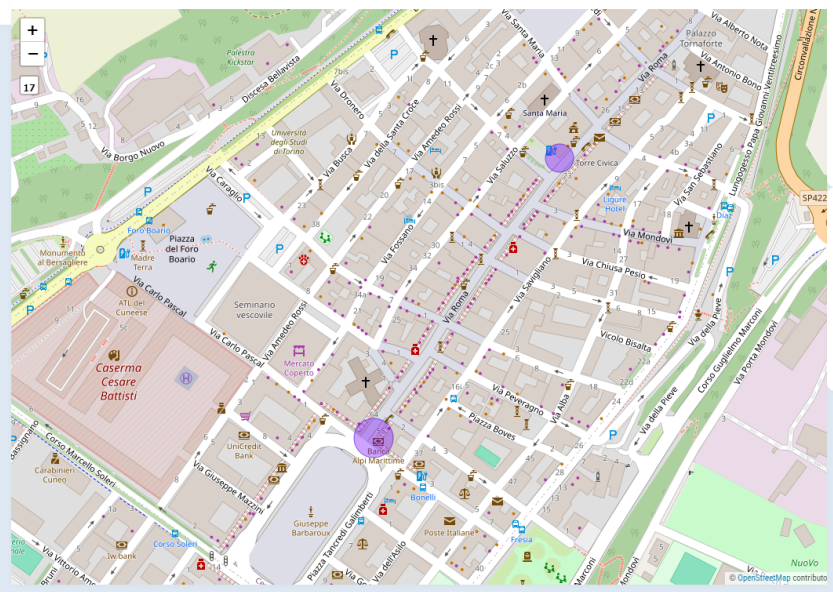
**1721612145 - GeneralStatus - Andamento Settimanale**

## Telecamere Cuneo

Thu 28 Mar 11:18:02



## Conteggi Telecamere



Powered by SNAP4Tech

**Legenda**

- 181
- 9
- 22
- 0

**Selector - Map**

TC01010  
VALUE NAME: 172

Last update: 2024-02-02 14:05:50 101Z

Description	Value
dateObserved	02/02/24, 03:05:50 PM
generalStatus	2

My Profile

My Profile

Previous



Building / Floor / Parking:

Building

All / Single Building:

All

Variable:

occupancy

Popup on Shape Click

Add To Map



ISPRA Site



- Date Observed: 10/23/2023, 12:30:01 PM
- Capacity: 2936 #
- Allocation: 1995 #
- Occupancy: 883 #
  - DAC: -941 #
  - DOA: -1112 #
  - DOC: -2053 #
  - PAC: 67.95 %
  - POA: 44.26 %
  - POC: 30.07 %
- Energy Hot: 4473978 kWh
- Energy Cold: 916361 kWh
- Power Hot: 36 kW
- Power Cold: 0 kW

Ispra - Occupancy 8m

883

Ispra - Occupancy

8m



person My Profile



## ISPRA JRC Site

### Ispra Floor, Zone And Room Details

Fri 6 Oct 18:41:54

**Allocation Number**

- >50
- 25-50
- 13-25
- 5-13
- 0-5

**Floor PT of Building 58A**

- Date Observed: 10/6/2023, 6:30:02 PM
- Capacity: 37
- Allocation: 31
- Occupancy: 1
  - DAC: -6 #
  - DOA: -30 #
  - DOC: -36 #
  - PAC: 83.78 %
  - POA: 3.23 %
  - POC: 2.7 %

[See Trends](#)

Select a Zone metric: Allocation

**Room 017**

- Date Observed: 10/6/2023, 12:01:00 PM
- Zone Id: 58A\_PT\_B
- Capacity: 1
- Allocation: 0
- mq: 12.16
- Average hourly temp. Xi: 24.07°C
- Average hourly temp. Xs: 20.92°C
- Average hourly temp. Xt: 6.00°C
- Heat Start temp.: 17.92°C
- Cold Start temp.: 23.92°C

[See Trends](#)

### Building 58A PT Trends

Mon 9 Oct 13:51:30

**Actual** 4m

**Capacity - Allocation - Occupancy** 4m

**Organization: Orion-1: Floor2\_58A\_PT - Occupancy** 9m

**Temp.** 9m

21.7

°C

**Percentage Per Zones - Monthly Time Trend Comparison** 4m

**Occupancy Per Zones - Monthly Time Trend Comparison Stacked** 4m



Ciao roottooladmin!

Tue 3 May 14:37:14

## DIDA DATA 2 - NEWGUI

**7** AFFORDABLE AND  
CLEAN ENERGY

**11** SUSTAINABLE CITIES  
AND COMMUNITIES

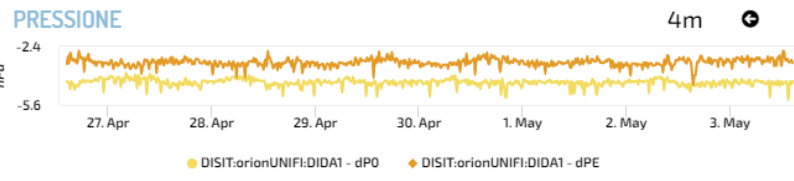
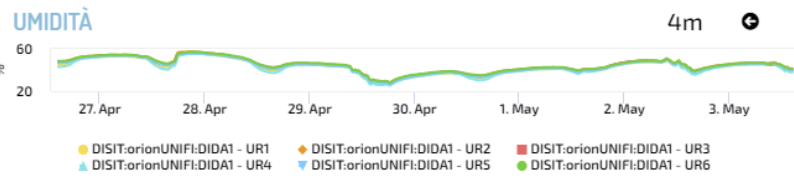
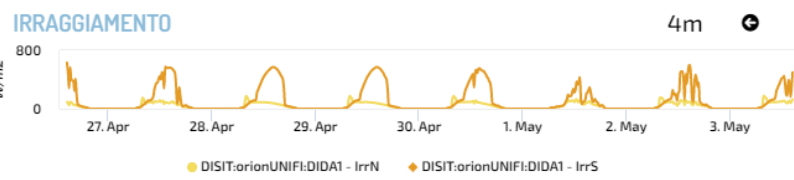
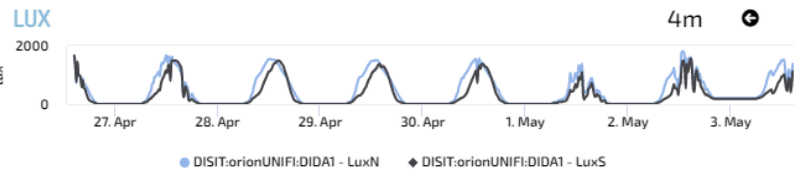
to see BIM log as user: info@disit.org, passwd: guest

### BIM SANTA VERDIANA



Last Value

Time Trend Chart: Glob - Day



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MzI4OA==>



# Environmental and Weather

PROGRAMMING & MANAGING WEB AND FLEXIBLE WEB AND MOBILE APPS

SNAP4CITY FOR BEGINNERS

SNAP4CITY

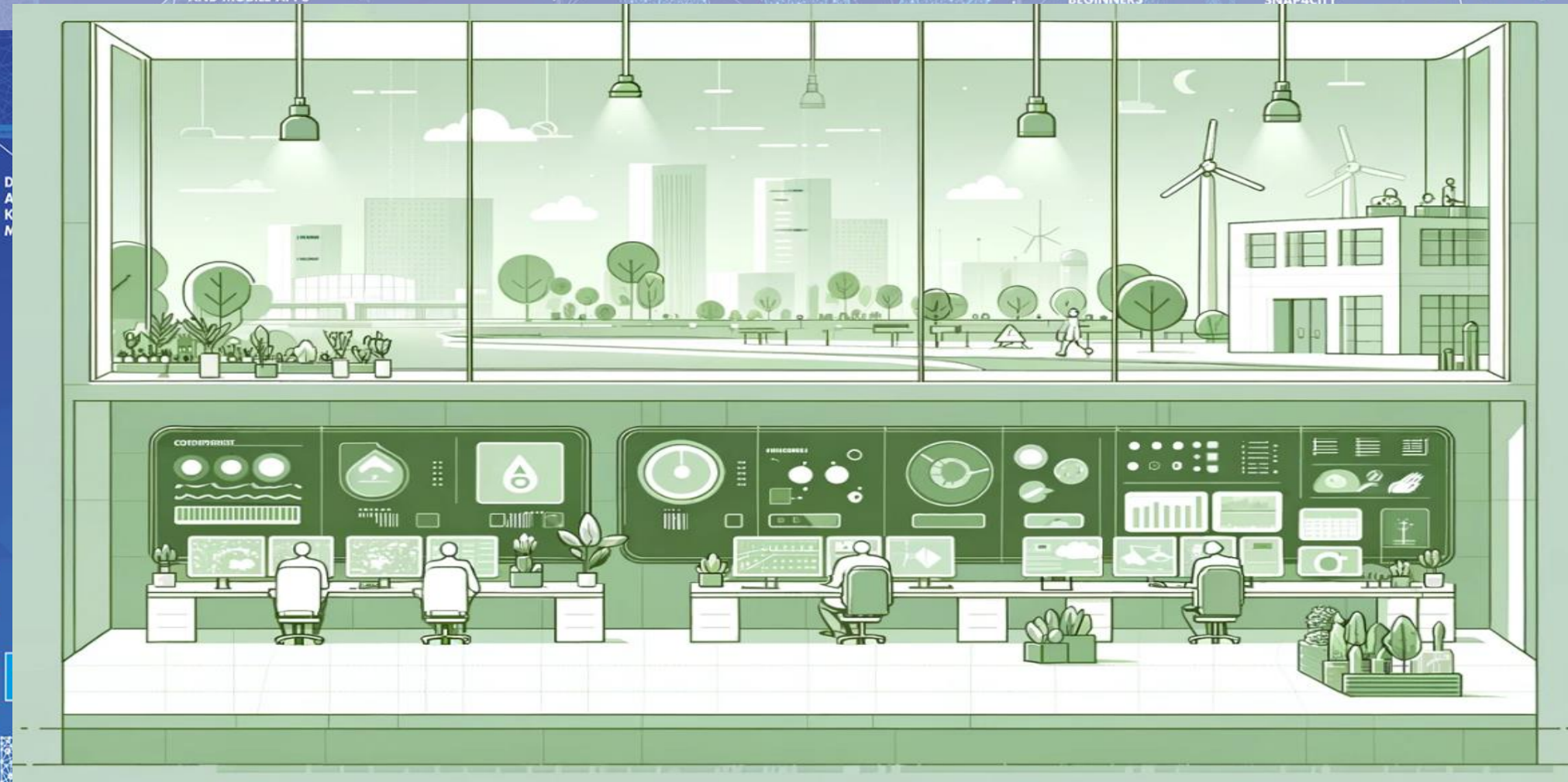
TWITTER BALANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY AND KM4CITY PROJECTS

FROM CITY DASHBOARD TO APPLICATIONS

ADOPT, COPY, AND SHAR

SNAP4CITY THE VIEW OF THE ADMINISTRATORS





# Environment and Quality of Life

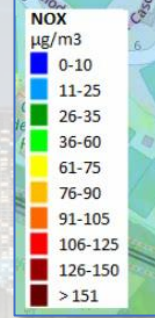
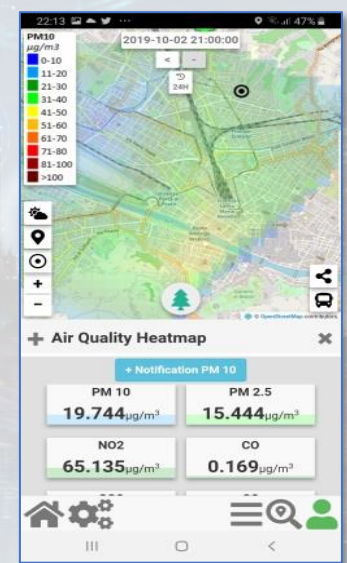
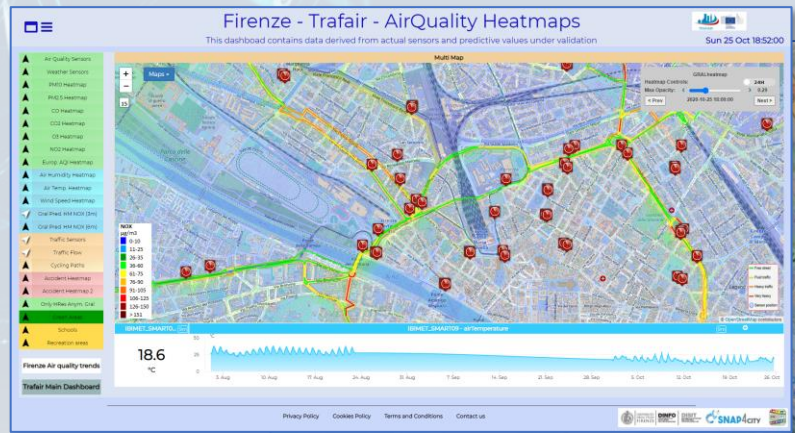
## Air Quality Predictions

Cities of: Firenze, Pisa, Livorno

reference



- **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**



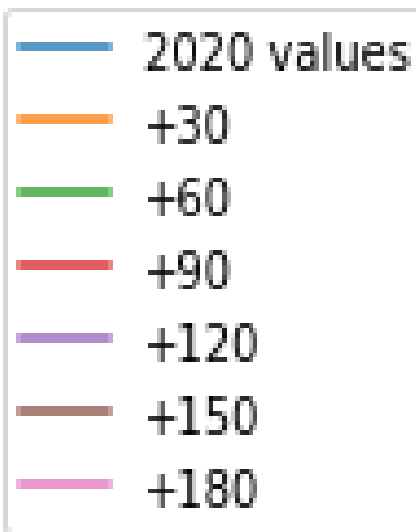
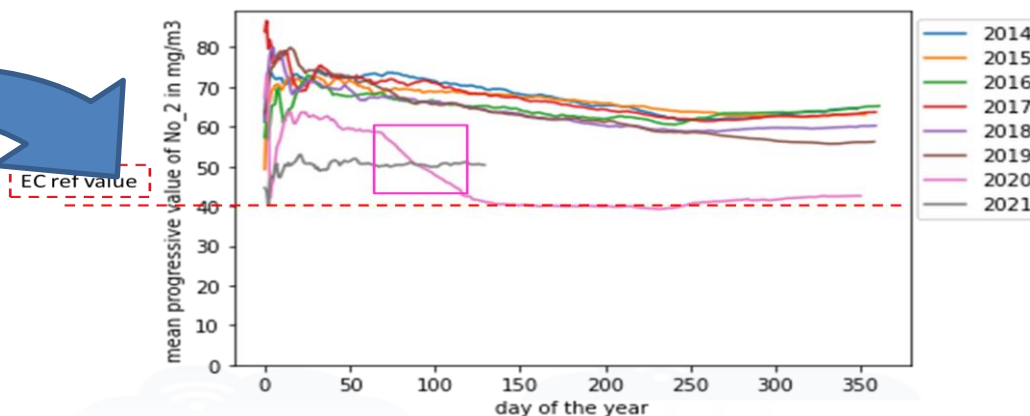
Pollutant	Averaging period	Air Quality Directive		WHO guidelines	
		Objective and legal nature and concentration	Comments	Concentration	Comments
PM <sub>2.5</sub>	One day	Limit value, 50 µg/m <sup>3</sup>	Not to be exceeded on more than 35 days per year	25 µg/m <sup>3</sup> (*)	99 <sup>th</sup> percentile (3 days/year)
PM <sub>2.5</sub>	Calendar year	Target value, 25 µg/m <sup>3</sup>	The target value should be achieved by 2015	10 µg/m <sup>3</sup>	
PM <sub>10</sub>	One day	Limit value, 50 µg/m <sup>3</sup>	Not to be exceeded on more than 35 days per year	50 µg/m <sup>3</sup> (*)	99 <sup>th</sup> percentile (3 days/year)
PM <sub>10</sub>	Calendar year	Limit value, 40 µg/m <sup>3</sup> (*)		20 µg/m <sup>3</sup>	
O <sub>3</sub>	Maximum daily 8-hour mean	Target value, 120 µg/m <sup>3</sup>	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m <sup>3</sup>	
NO <sub>2</sub>	One hour	Limit value, 200 µg/m <sup>3</sup> (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m <sup>3</sup> (*)	
NO <sub>2</sub>	Calendar year	Limit value, 40 µg/m <sup>3</sup>		40 µg/m <sup>3</sup>	

**KPI of EC**



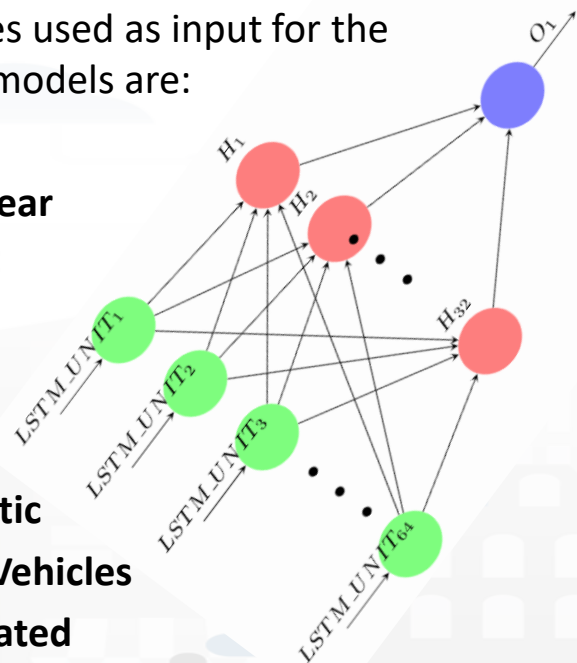
# Predicting EC's KPI on NO2 months in advance

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**
- **NO2progesseveMean**
- **numberOfVehiclesCumulated**



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

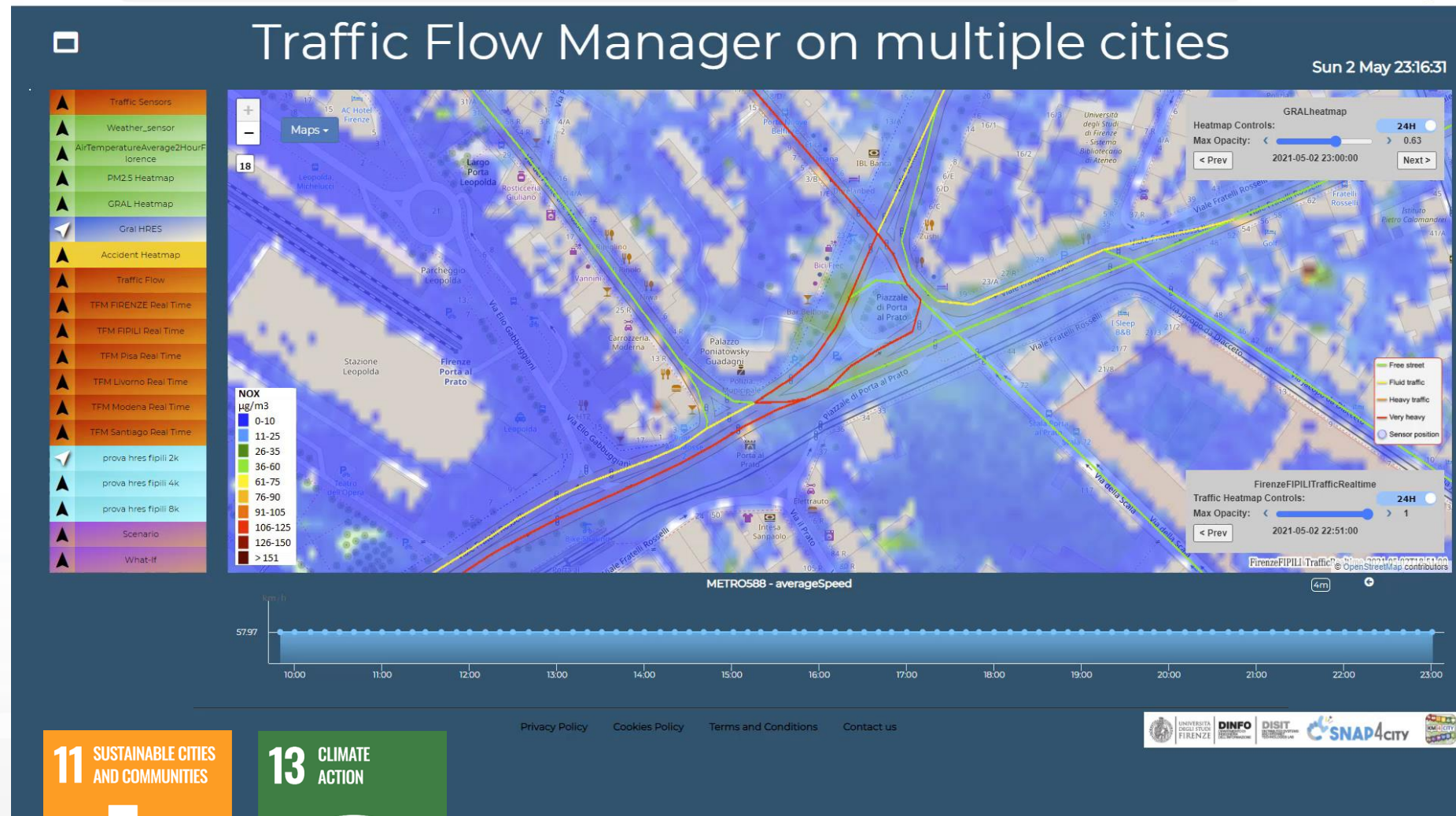


- **Prediction**

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

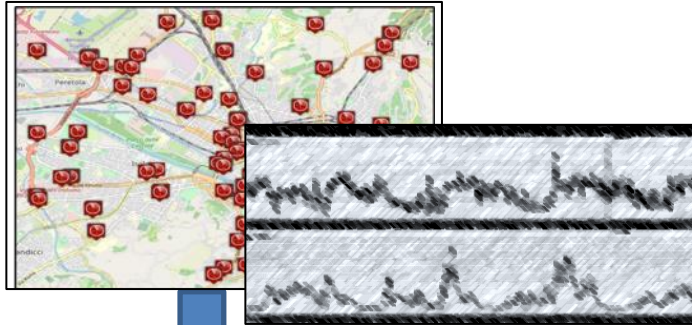
- **Project:**

- **Trafair CEF EC**
- **Mixed solutions** of Fluidinamics modeling and AI

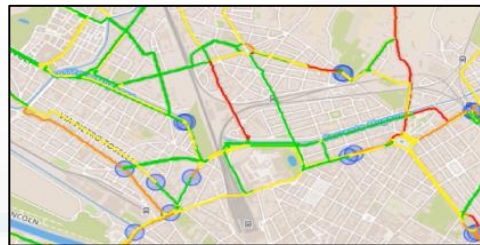




# Estimating City Local CO2 from Traffic Flow Data



Computing Traffic Flow  
into CO2 sensor area



Traffic Flow data

- Traffic Flow is one the main source of CO2 (gCO2/km x Vehicle)
  - K1: Fluid Flow
  - K2: Stop and Go
- **Dense estimation of CO2 into the city** is very useful to know to target EC's KPIs

Computing CO2 on the basis of  
traffic flow data



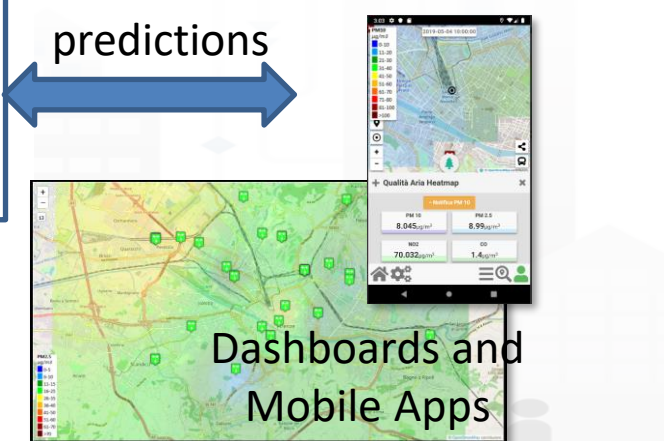
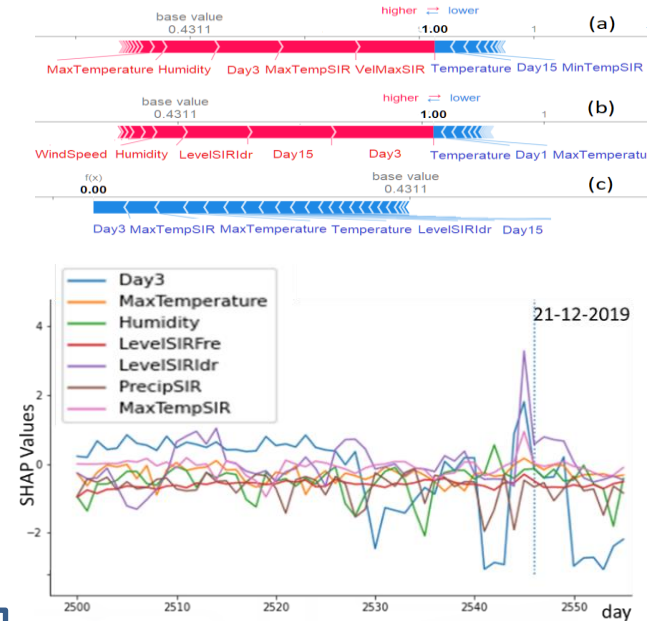
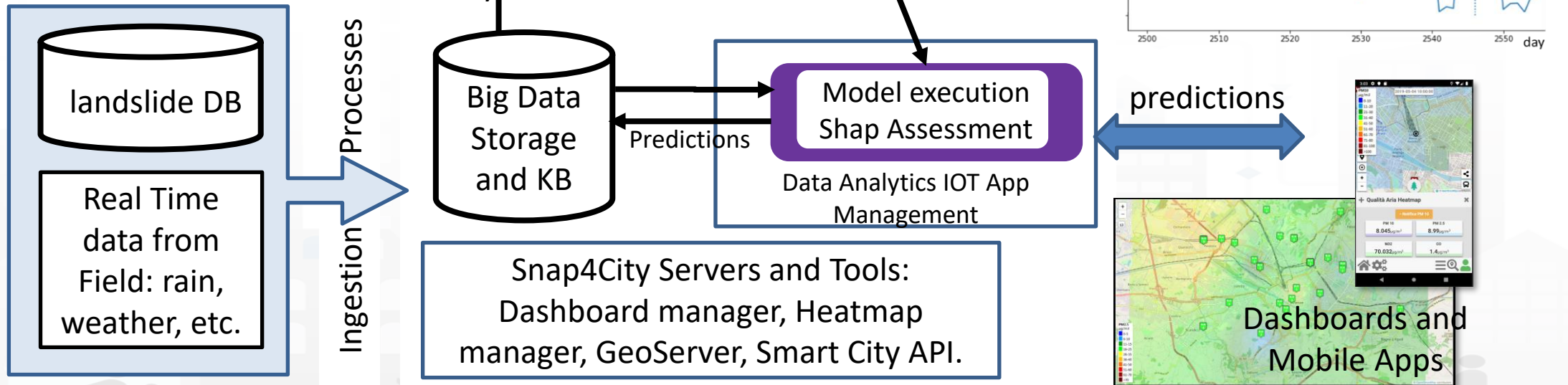
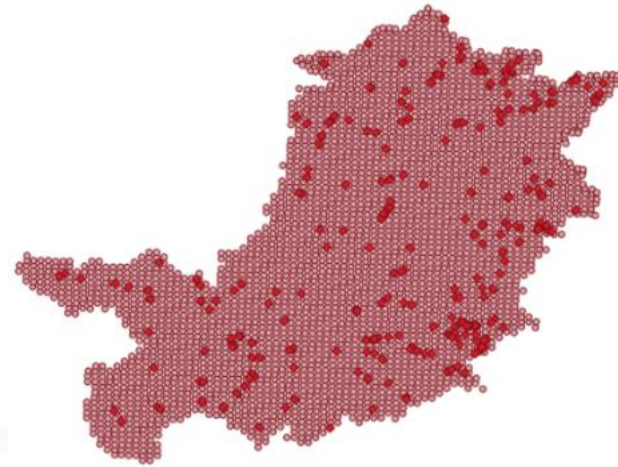
CO2 estimation



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 Land slides





# Human Behavior Monitoring

DESIGNING  
MULTI-PLATFORM  
AND FLEXIBLE WEB  
AND MOBILE APPS

TWITTER  
FACEBOOK  
SOCIAL  
MEDIA ANALYSIS

SNAP4CITY FOR  
BEGINNERS

SNAP4CITY  
ARCHITECTURE AND  
PROJECTS

SNAP4CITY  
AND KM4CITY  
PROJECTS

FROM CITY  
DASHBOARD TO  
APPLICATIONS

SNAP4CITY THE  
VIEW OF THE  
ADMINISTRATORS

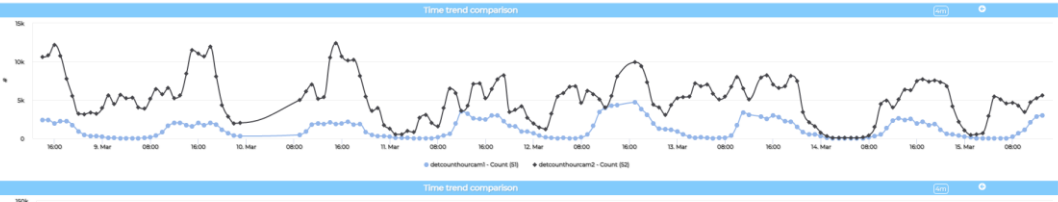






# A view and data from the Thermal Camera

Detection BOX Snap4Thermal PV Firenze Tue 15 Mar 13:30:41



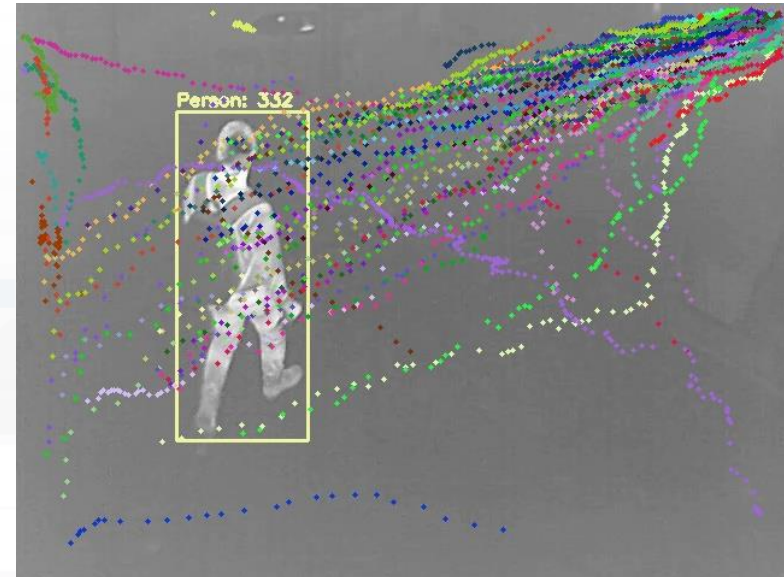
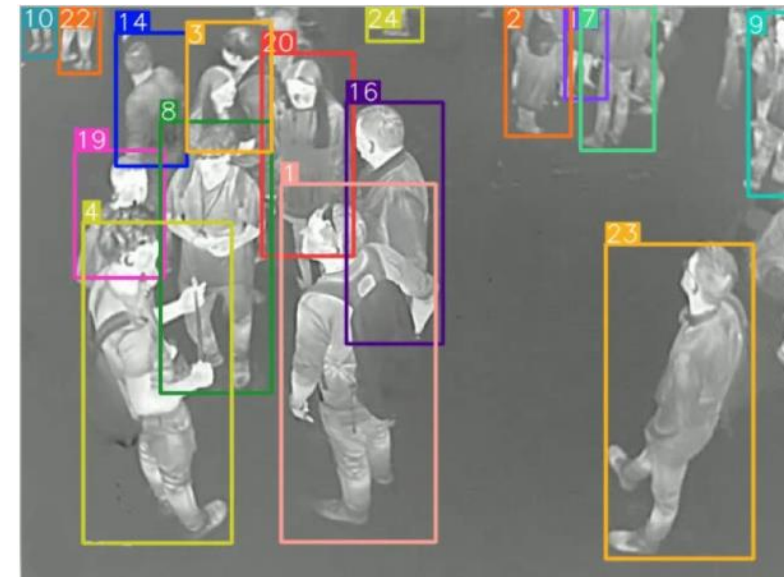
47  
persona  
carrozzina  
bike

11 SUSTAINABLE CITIES  
AND COMMUNITIES





# People Counting and Tracking



11 SUSTAINABLE CITIES  
AND COMMUNITIES



3X



# Engaging via Mobile Apps

FROM CITY  
DASHBOARD TO  
APPLICATIONS

DATA  
AND KNOW  
MAN



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STOP

SNAP4CITY  
AND KM4CITY  
PROJECTS

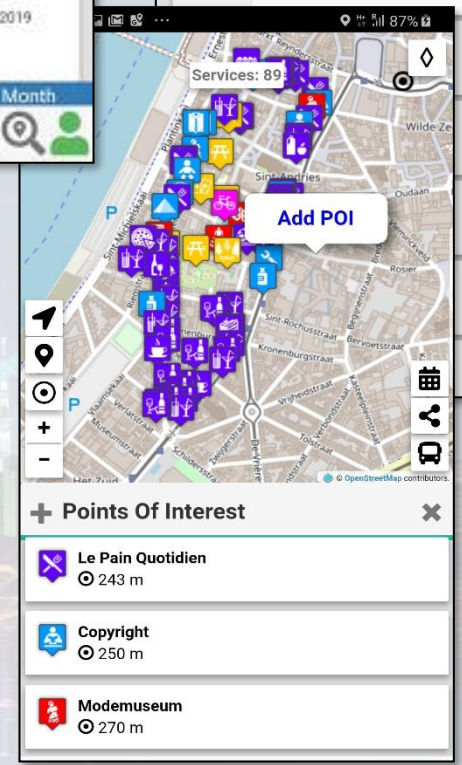
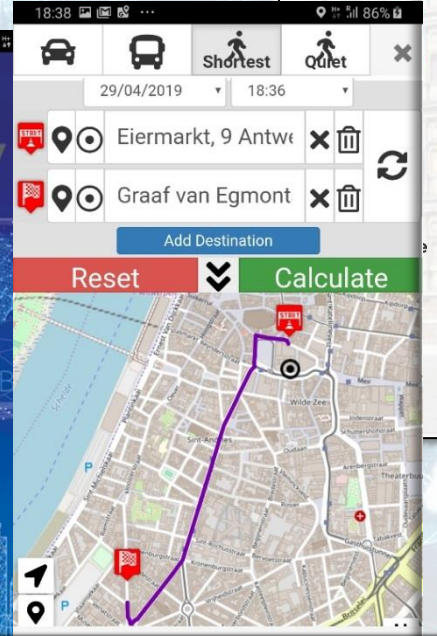
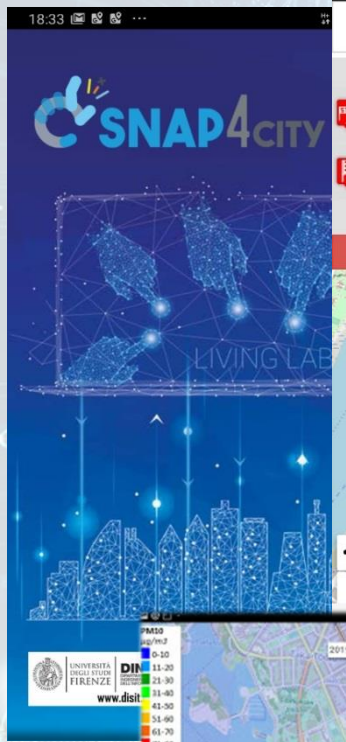
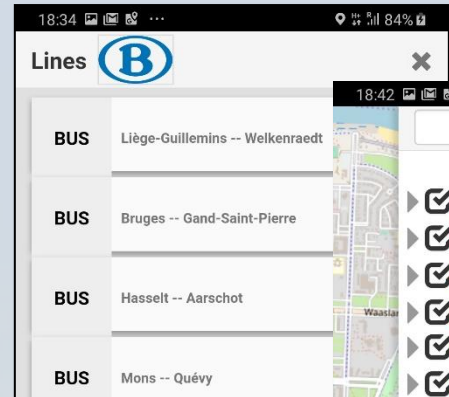
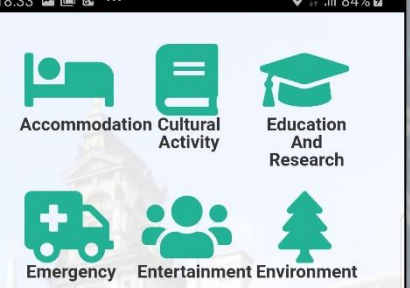
TO ADOPT  
4CITY, AND  
ROADMAP

SNAP4CITY THE  
VIEW OF THE  
ADMINISTRATORS



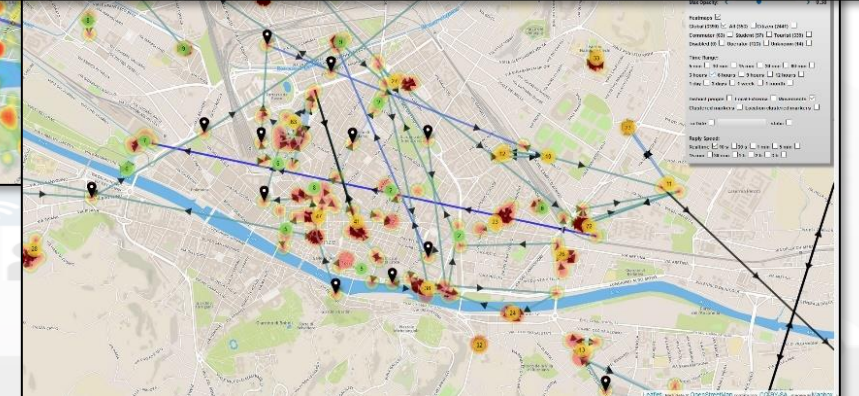
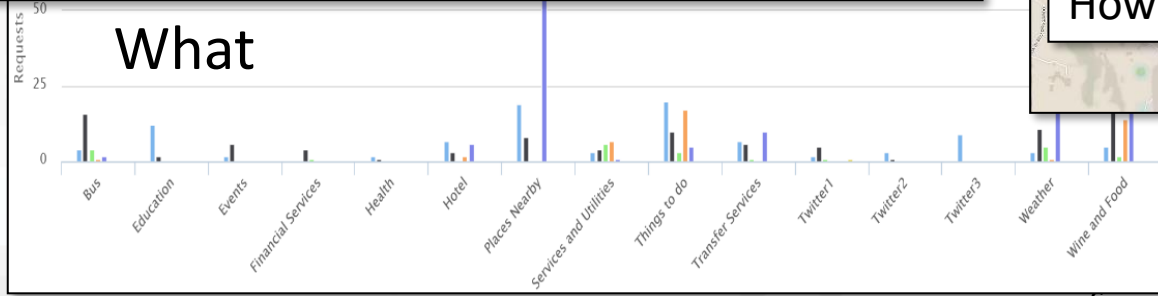
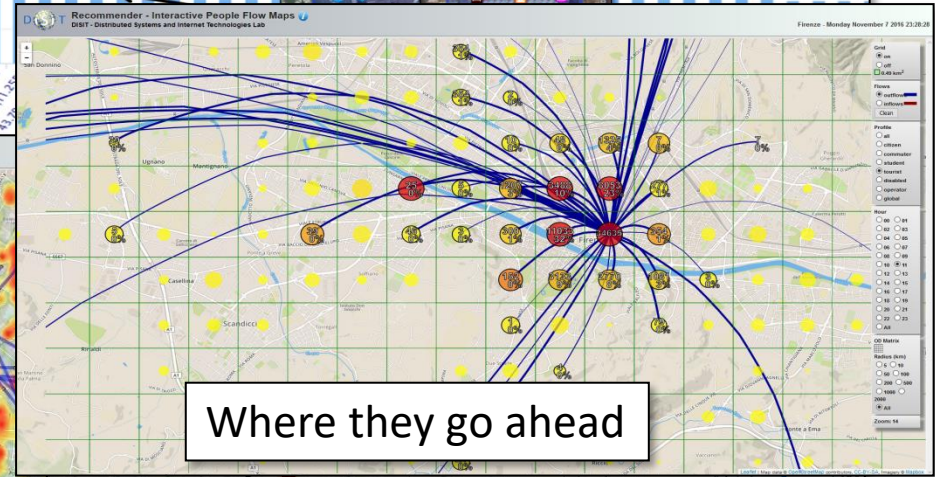
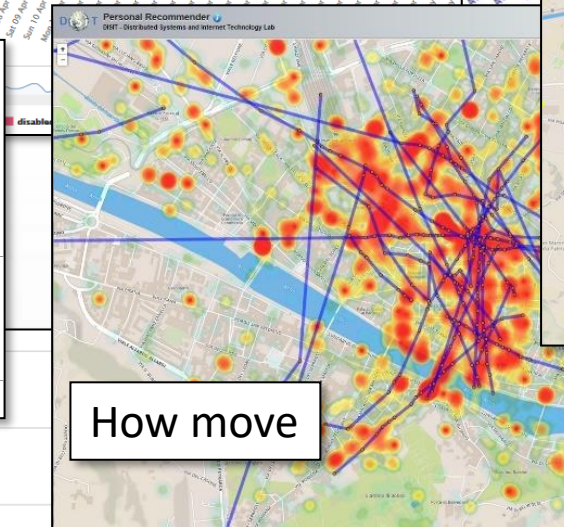
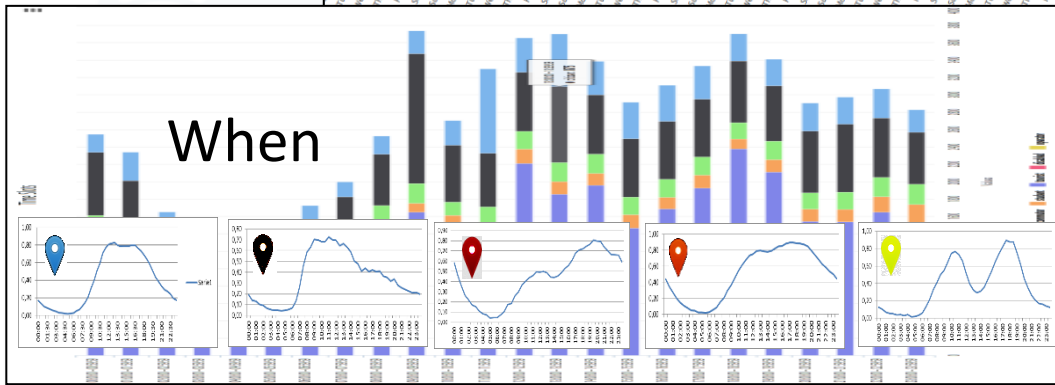
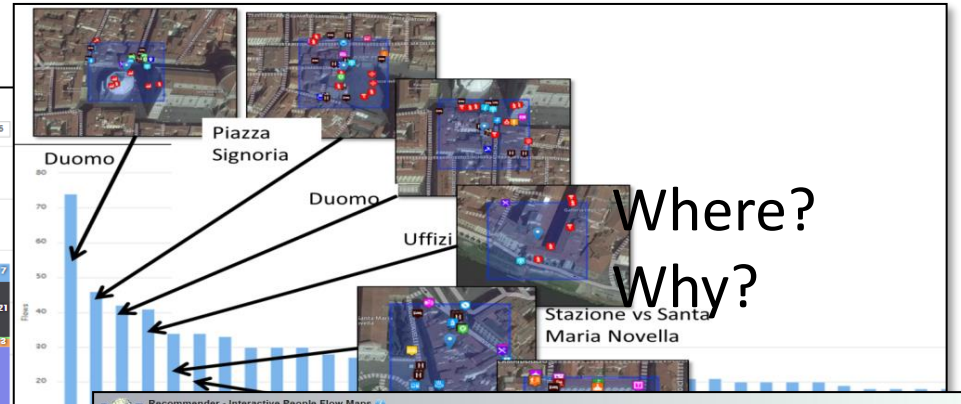
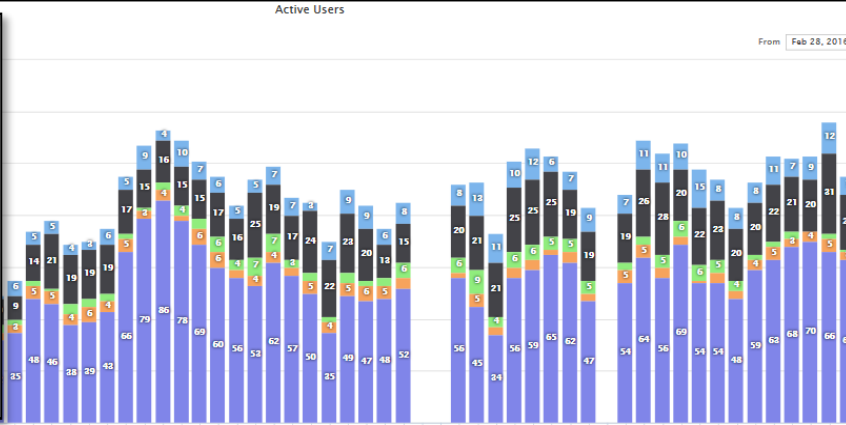
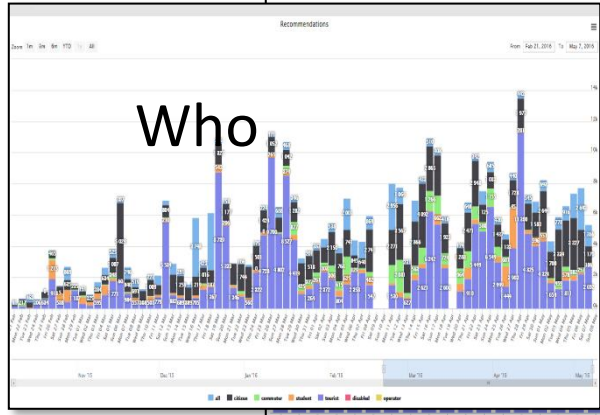
100%  
OPEN  
SOURCE







# User Behavior Analyser for Collective Profiling





# 2023 booklets



- Smart City



[https://www.snap4city.org/download/video/DPL\\_SNAP4CITY.pdf](https://www.snap4city.org/download/video/DPL_SNAP4CITY.pdf)

- Industry



[https://www.snap4city.org/download/video/DPL\\_SNAP4INDUSTRY.pdf](https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY.pdf)

- Artificial Intelligence



[https://www.snap4city.org/download/video/DPL\\_SNAP4SOLU.pdf](https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf)



# <https://www.snap4city.org/4>

- [Scenario: SnapBot: Real Time Smart City services via Telegram](#)
- [Scenario: Copernicus Satellite Data](#)
- [Scenario: SmartBed, Materasso Intelligente](#)
- [MicroServices Suite for Smart City Applications](#)
- [Scenario: MODBUS for Snap4Industry Snap4City Applications](#)
- [Scenario: MOBIMART Interreg: MOBilità Intelligente MARE Terra](#)
- [Scenario: City of Roma case, mobility and environmental data](#)
- [Scenario: Herit-Data video and aims](#)
- [Scenario: Control Room vs Video Wall](#)
- [Scenario: Snap4Home the case of: Alexa, Philips, Sonoff, TP-link, etc. \(Italiano\)](#)
- [Scenario: how to manage maintenance and accidents workflows](#)
- [Scenario: Snap4Home, how to exploit Snap4City solution on home automation](#)
- [Scenario: Energy Monitoring](#)
- [Scenario: Multipurpose User Engagement Tools](#)
- [Scenario: 5G Enabled Water Cleaning Control \(smart city, industry 4.0\)](#)
- [Scenario: High Level Control of Industrial Plant \(industry 4.0\)](#)
- [Scenario: Vehicle Monitoring via OBD2](#)
- [Scenario: Events and Museums Monitoring in Antwerp](#)
- [Scenario: High Resolution Prediction of Environmental Data](#)
- [Scenario: Mobility and Transport Analyses in multiple cities](#)
- [Scenario: People Flow Analysis via Wi-Fi](#)
- [Scenario: Antwerp Pilot on Environmental Data](#)
- [Scenario: Helsinki Pilot on Environmental Data](#)
- [Scenario: Firenze Smart City Control Room](#)
- [Scenario: Mobile & Web App: Toscana Where What ... Km4City, Toscana in a Snap](#)
- [Scenario: Helsinki Pilot on User Behaviour](#)
- [Scenario: Antwerp Pilot on User Behaviour](#)



## Scenariious

- [Data Analytic: Origin Destination Matrices, Algorithms and tools](#)
- [Data Analytic: Traffic Flow Reconstruction](#)
- [Data Analytic: in general, and the cases of Antwerp and Helsinki](#)
- [Data Analytic: Predicting Air Quality](#)
- [Data Analytic: Analyzing Public Transportation Offer wrt Mobility Demand](#)



# Tech Overview

- <https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf>



### Technical Overview

From: DINFO dept of University of Florence, with its  
DISIT Lab, <https://www.disit.org> with its Snap4City solution

Snap4City:

- Web page: <https://www.snap4city.org>
- <https://twitter.com/snap4city>
- <https://www.facebook.com/snap4city>

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# Development

<https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf>



## Development Life-Cycle

<https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle-v1-1.pdf>

### From Snap4City:

- We suggest you to read the **TECHNICAL OVERVIEW**:
  - <https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf>
- <https://www.snap4city.org>
- <https://www.snap4solutions.org>
- <https://www.snap4industry.org>
- <https://twitter.com/snap4city>
- <https://www.facebook.com/snap4city>
- <https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandq>

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*Be smart in a SNAP!*



## CONTACT

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