

Smart Tourism Via Digital Twins



DIGITAL TWIN SOLUTIONS TO SETUP SUSTAINABLE DECISON SUPPORT SYSTEMS AND BUSINESS INTELLI























Goals	How to	technicalities
Keep under control reputation	Measuring and predicting	Multichannel collections of appreciations, AI/LLM, sentiment analysis
Predicting number of presences in advances	Measuring and predicting	Counting, tracking and computing Orig. Dest. Matrices
Controlling the overtourism	Measuring, predicting, suggesting, producing tactics and strategies	Production of suggestions, serious games, engagements,
Stimulating actions, stimulating the second offer	Suggesting, engaging, producing tactics and strategies	Production of suggestions, and engagements
Identification of critical conditions	Short and long terms Measuring	In deep data analysis, AI for anomaly detections
Increasing resilience	Monitoring and early warning	Strategies, dynamic routing, real time information to city users









City User behavior analysis multiple data sources

Main Data Sources:

- Mobile Cell data from telecom operators, macro areas
- Mobile App data from their operators, micro areas
- OBU from Insurance operators, only private vehicles
- Social media: limited information and quality
- Local Operators of: museum, ticket office, restaurants, etc.
- Data integrators: a mixt of the above, not clear methods

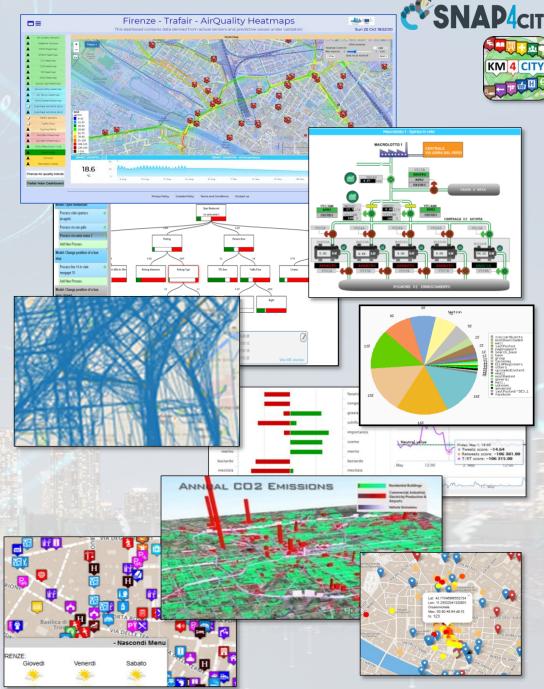
Sensor Data:

- PAX Counters, Sniffer, Wi-Fi sniffers, Radar, laser, etc.
- TV Camera color, Thermal Cameras, radar track
- Snap4City: integration and computing tools for deductions

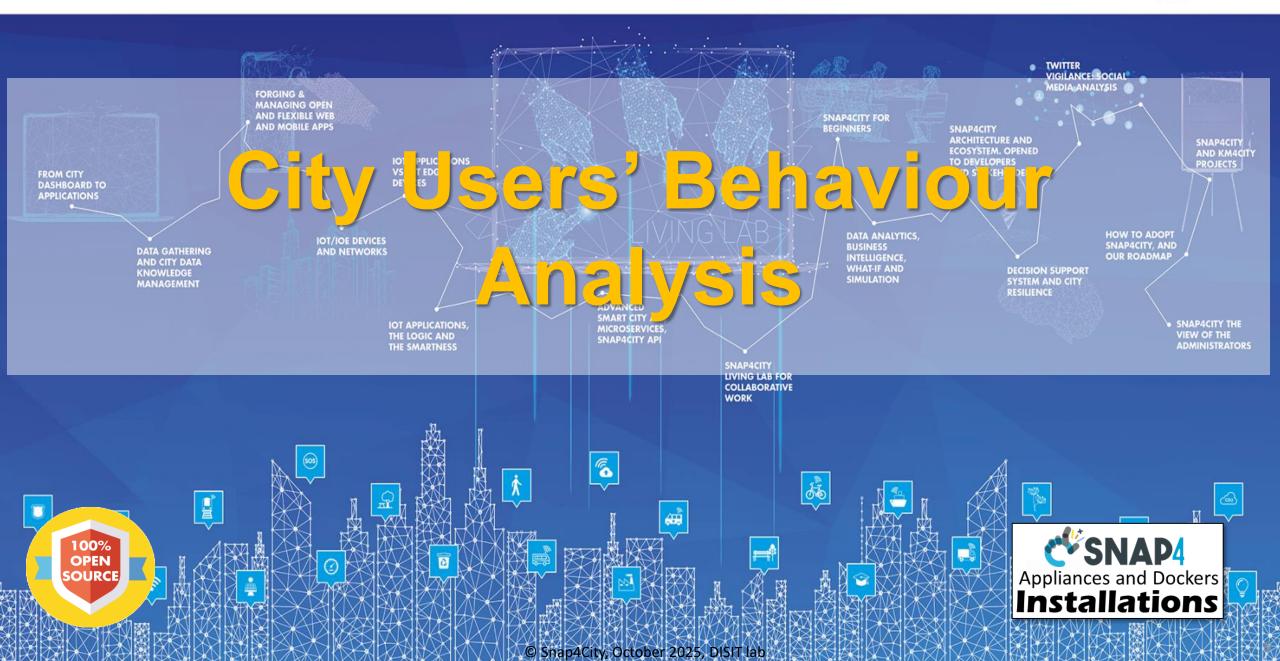
Data Driven Decision Support

- Decision Support system
- Assessment / Strategies
- Data Rendering,
 - visual analytics, business intel..
- Data Analytics, ML, Al
- Data aggregation, Storage, indexing
- Data Ingestion







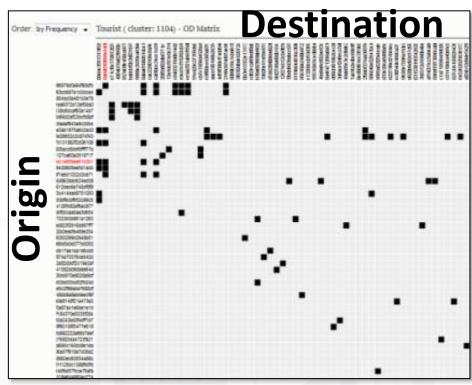






Origin Destination Matrices

- computed from several kinds of data
 - Census Data
 - Cellular Mobile Data
 - Mobile App Data trajectories
 - OBU from vehicles trajectories
 - Composition of multiple sources: ODM + Trj
- may represent:
 - Demand of mobility, effective movements,...
 - Offer of transportation
- refer to different area kinds for Origin and of Destination
 - Different kinds of OD areas
 - Different kinds of temporal resolutions → animations
 - Hourly, daily, weekly, monthly, etc...



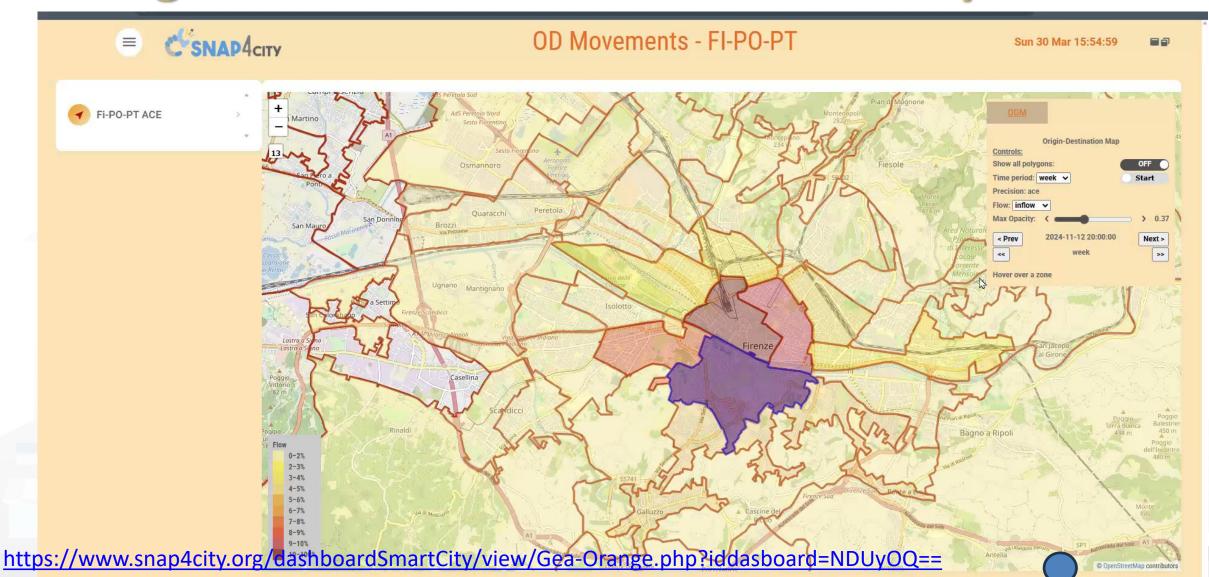








Origin Destination Matrices: Mobility Demand





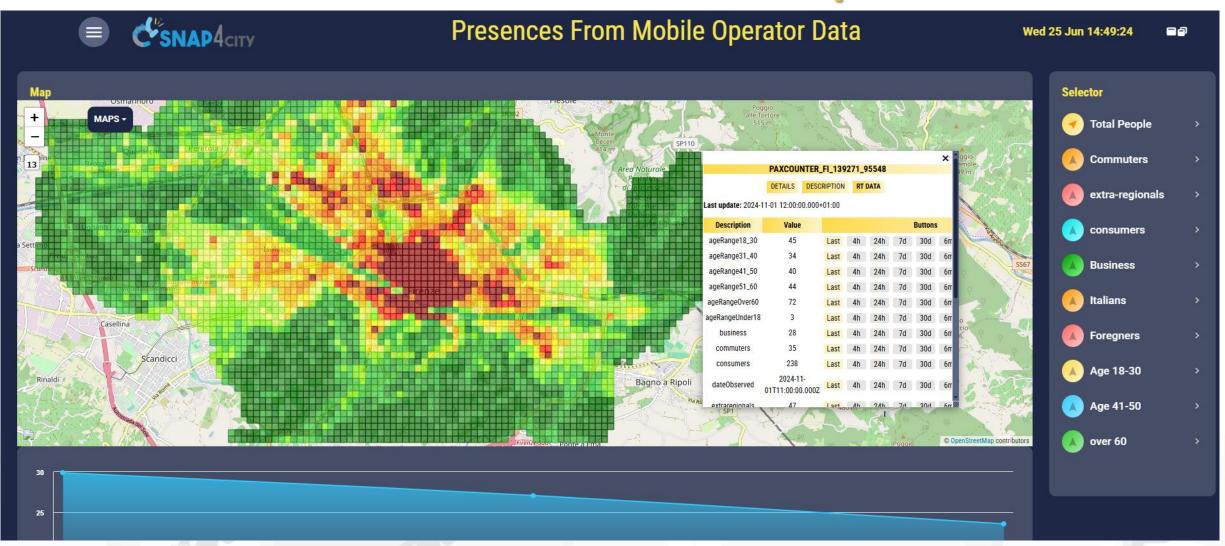








Presences from Mobile Operator











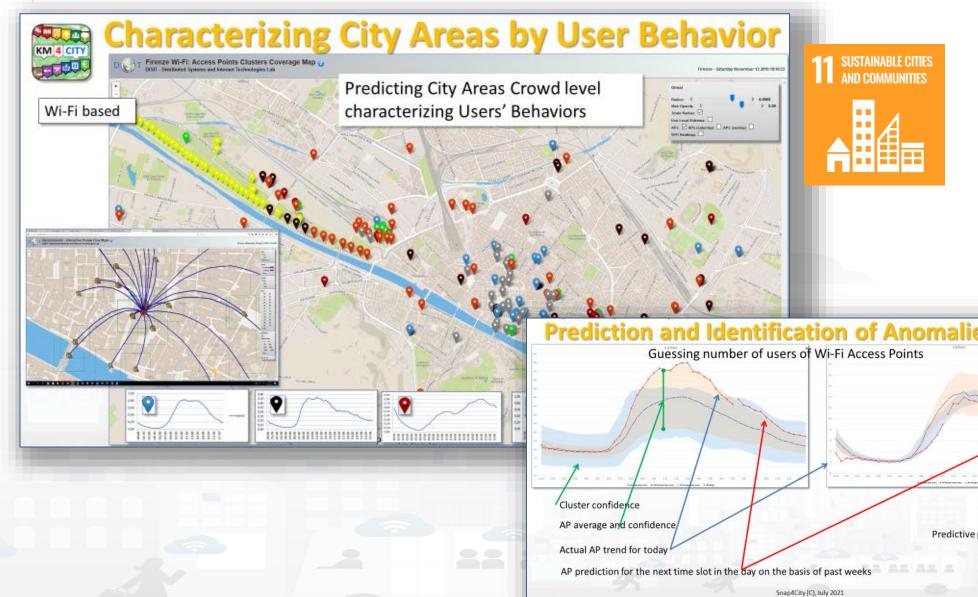


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- **AI Prediction of** people flows on the basis of Wi-Fi data
- **Anomaly** detection
- Classification of city areas



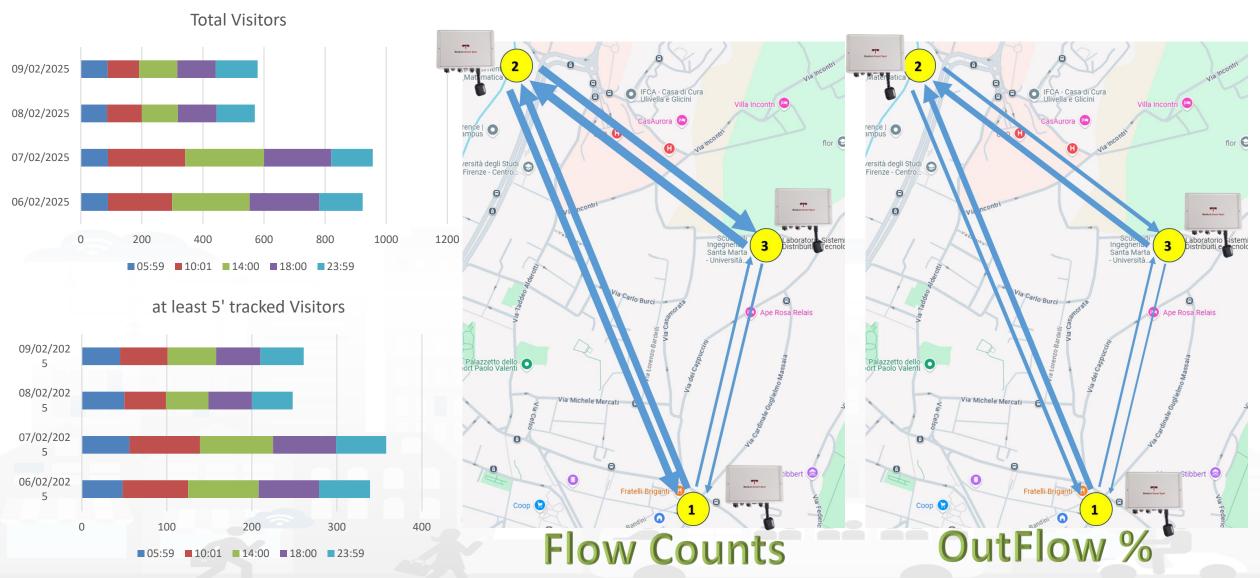


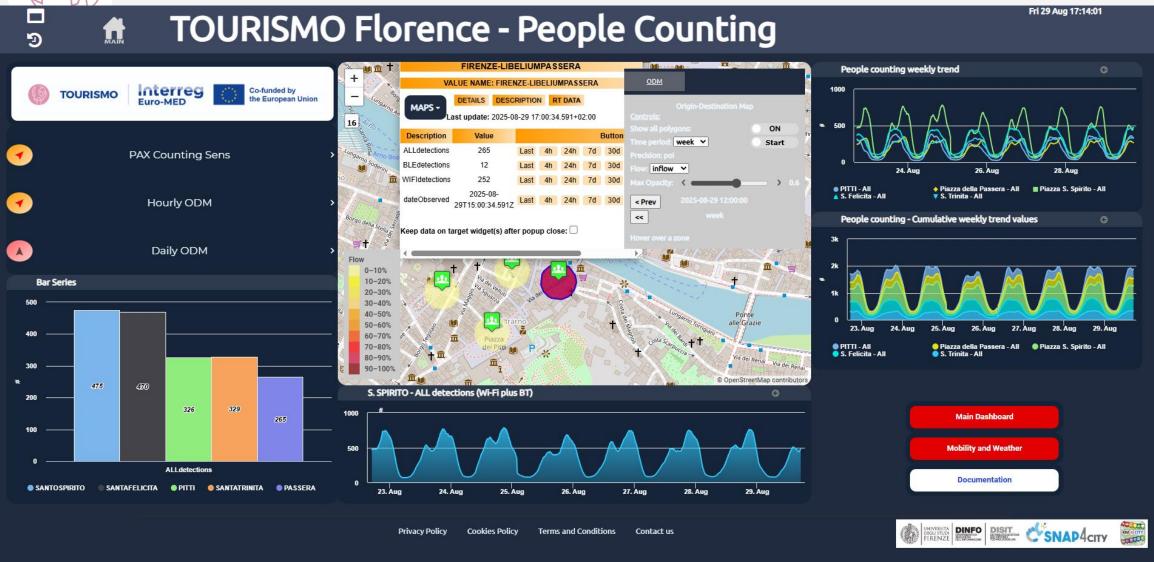






ODM PaxCounters















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

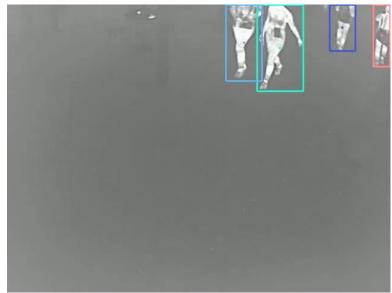
GDPR compliant

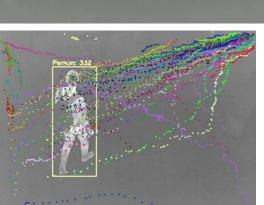
Al injection

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

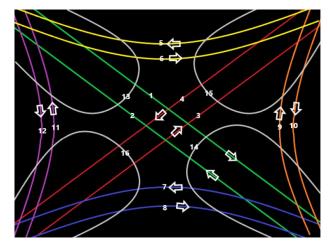
Real-time estimation

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











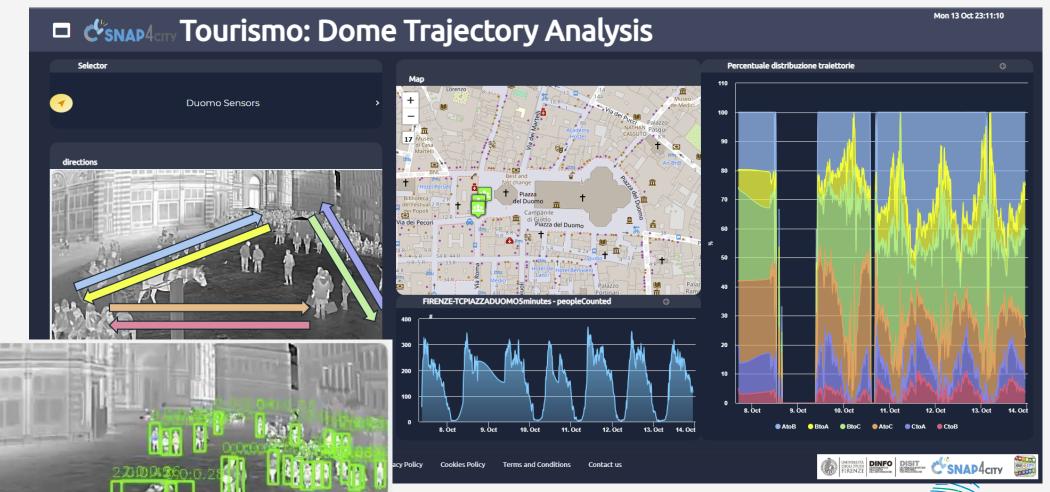


















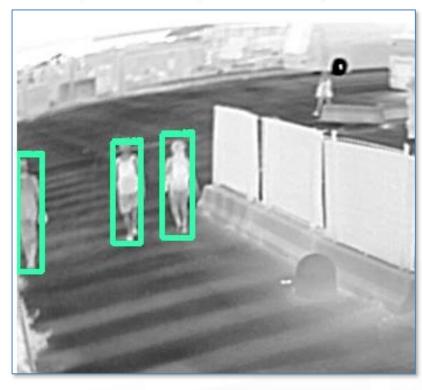










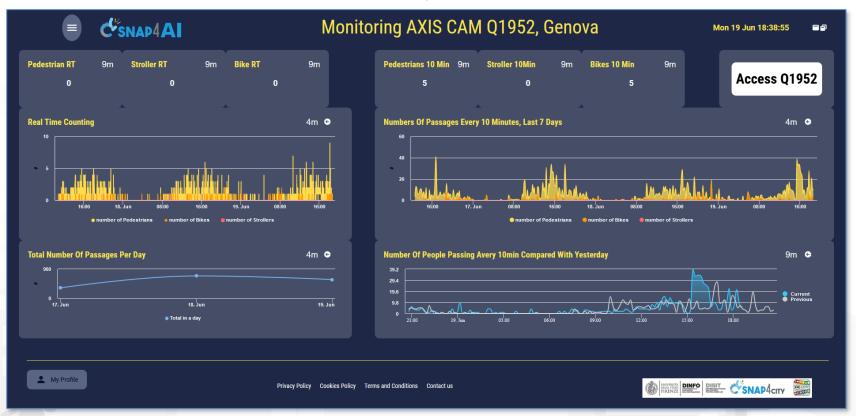


SUSTAINABLE CITIES AND COMMUNITIES

Monitoring Passages AXIS Q1952

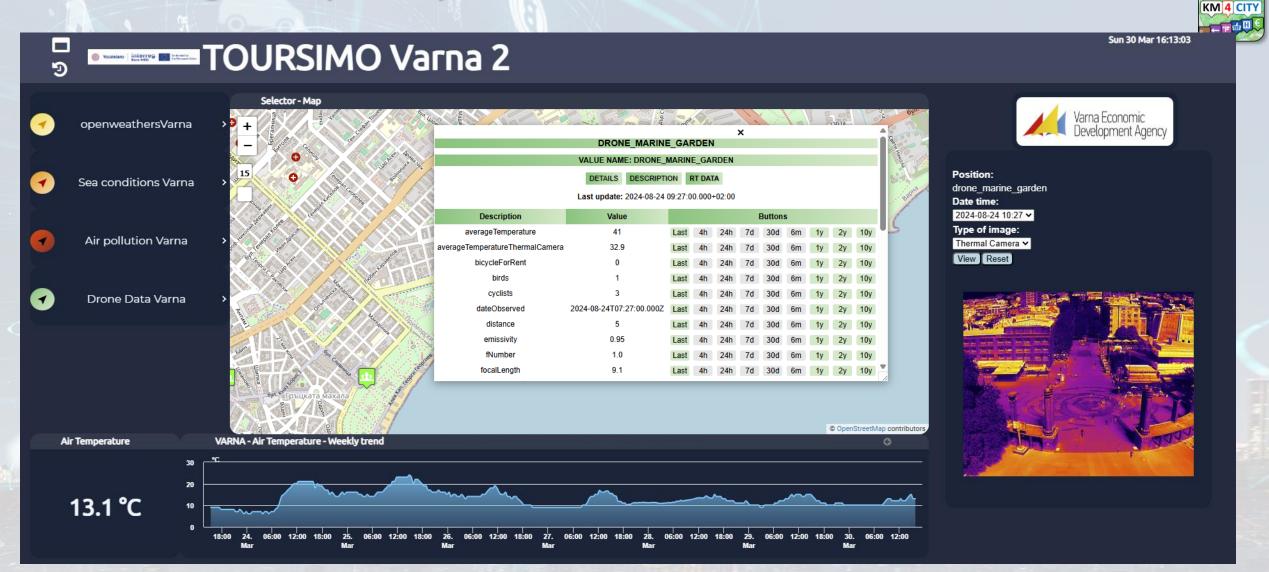


Genova: Ocean Race, 2023



Counting People by Drones in Varna

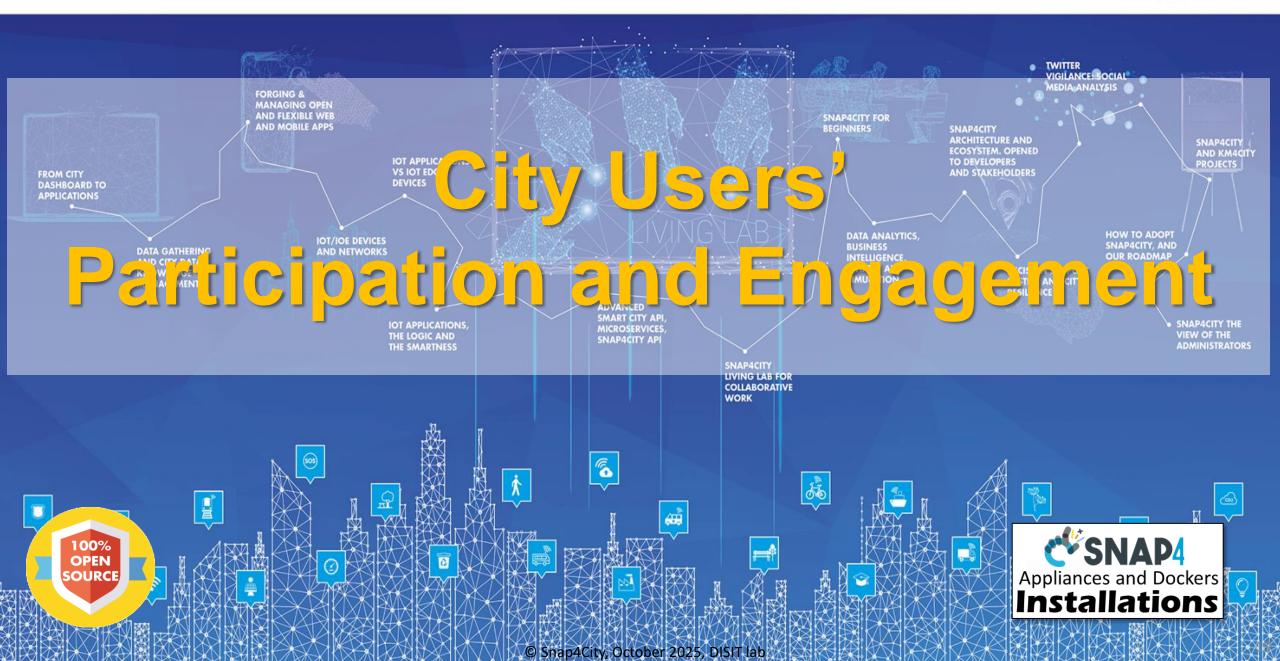




https://www.snap4city.org/dashboardSmartCity/view/newTheme.php?iddasboard=NDUxOA==















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 for sentiment analysis, text understanding, etc.

Engagement

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





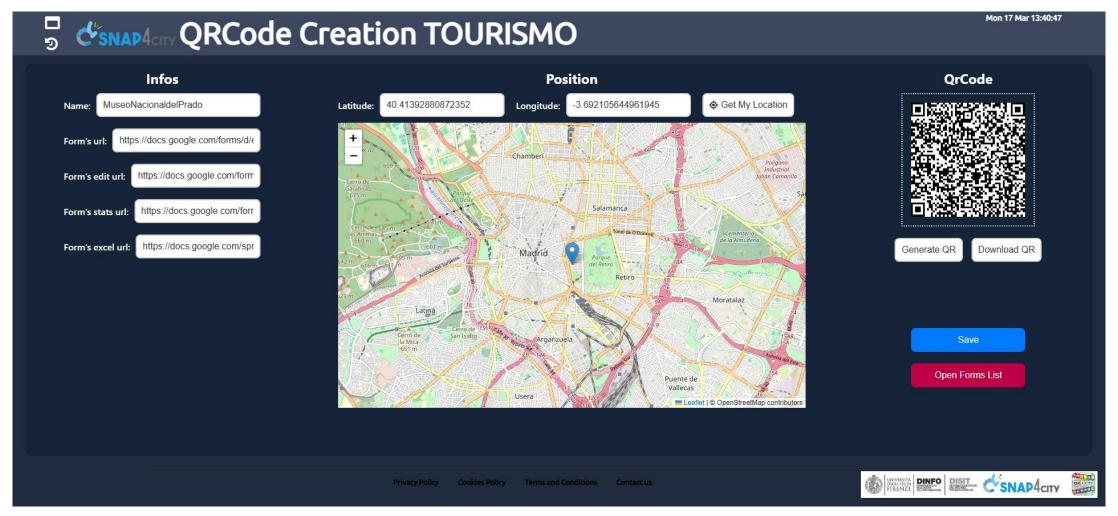








Complains Analysis to Support Decision Making Processes





Logged in as: edoardo tester



Your Profile

Logout

SnapAssistant model:

Llama3.3 V

New Chat

EdoChat1

EdoChat2

EdoChat3

EdoChat4

prova

chatNuova

chatTest1LLAMA

chatTest2LLAMA

testGianniLLAMA

testTastoInvioPreChanges

ChatTestPostPSWINVIO

https://www.snap4city.org/1116

SnapAdvisor

Current chat: debug0

Visualize references





Come creo una dashboard?

Per creare una dashboard, puoi utilizzare la piattaforma Snap4City. La dashboard si compone di un insieme di widget grafici che possono essere impostati separatamente assegnando una serie di parametri, come origine dati, dimensioni, colori, forma, font, allarmi, relazioni con altri, ecc. (SOURCE: Snap4 City per la creazione di Smart City Control Room, SCCR). Inoltre, la piattaforma offre la possibilità di creare vere e proprie applicazioni interattive, multipagina/multidashboard, e non semplici storie monopagina da scrollare. Puoi anche condividere la dashboard con altri utenti anche fuori dalla Smart City Control Room tramite canali autenticati e protetti in HTTPS, in accordo al GDPR (SOURCE: Snap4 City per la creazione di Smart City Control Room, SCCR). Per vedere alcuni esempi di dashboard, puoi visitare il sito https://www.snap4city.org/dashboardSmartCity/view/index.php? iddasboard=MjU0Mg== (SOURCE: Snap4 City 1st Overview v4 8 annot). Tuttavia, non ho trovato informazioni dettagliate sulla procedura di creazione di una dashboard. Se hai bisogno di ulteriore assistenza, ti consiglio di contattare direttamente il team di supporto di Snap4City. Non so dirti altro in merito.

















Complains Analysis to Support Decision Making Processes

Standard data/form creation for reputation analysis:

<u>Summary of Findings (June–August 2025, 36 responses received - Golden Bay, Malta)</u> produced by a Large Language Model (LLM) based on the responses obtained from questionnaire

Initial Sentiment
 Analysis/NLP by
 analysing
 questionnaires
 collected from QR
 code distribution.

Average Ratings (scale -2 to +2)

Overall experience: +0.67 → slightly positive but inconsistent (range -2 to +2)

Toilets: -0.83 → strongly negative, among the worst-rated aspects.

Showers: -0.31 → generally negative.

Bins distribution: -0.33 → slightly negative, with complaints about lack of bins.

Safety & lifeguard services: +0.55 → moderately positive.

Cleanliness: -0.52 → overall negative, many complaints about cigarette butts and plastics.

Natural conditions (dunes, seawater, etc.): -0.40 → negative, issues with seagrass, water quality.











DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

IOT APPLICATIONS





Reporting issuse white ovstlr Clinwing

FROM CITY
DASHBOARD TO
APPLICATIONS

VS IOT EDGE DEVICES

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT BEGINNERS
SNAP4CITY
ARCHITECTURE AND
ECOSYSTEM. OPENED
TO DEVELOPERS
AND STAKEHOLDERS

armact on Chricy

DECISION SUPPORT
SYSTEM AND CITY
RESILIENCE

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

SNAP4CITY

PROJECTS

AND KM4CITY

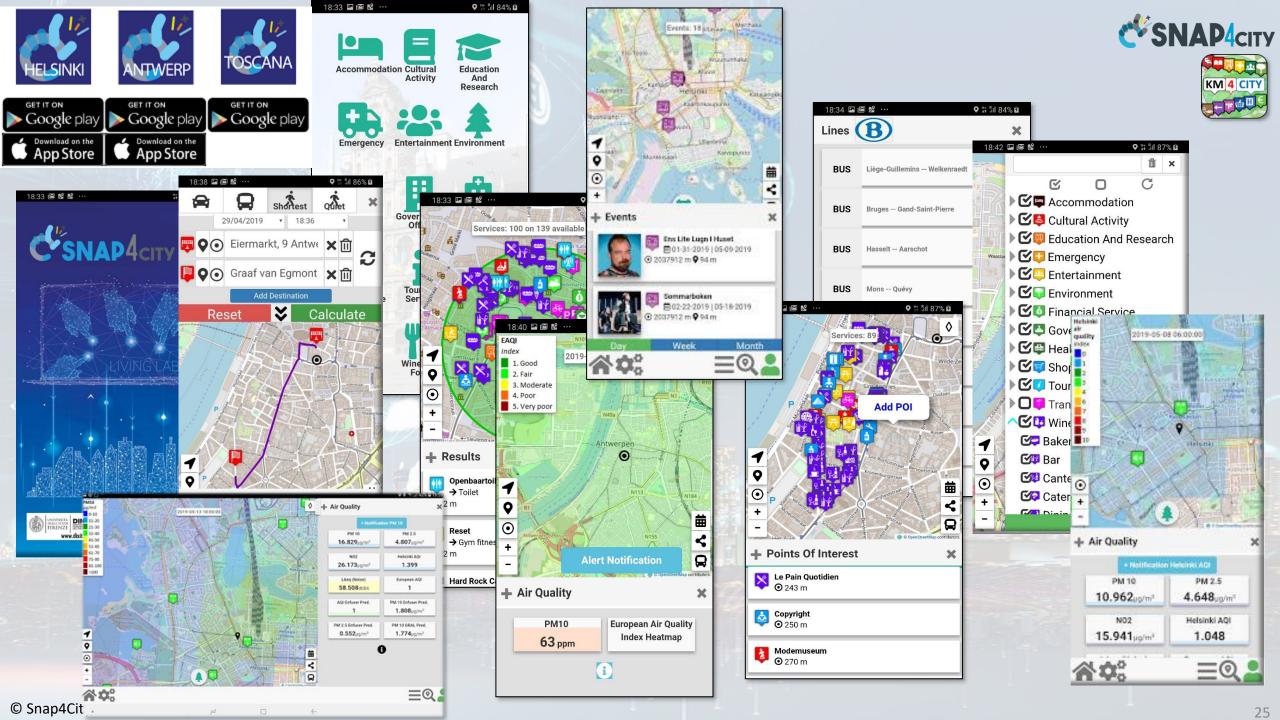












Citizen Engagement/Participation via Mobile Apps

- SNAP4city
 - KM 4 CITY

- 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?

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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

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Produced information

- Suggestions
- Engagements
- Notifications
- System

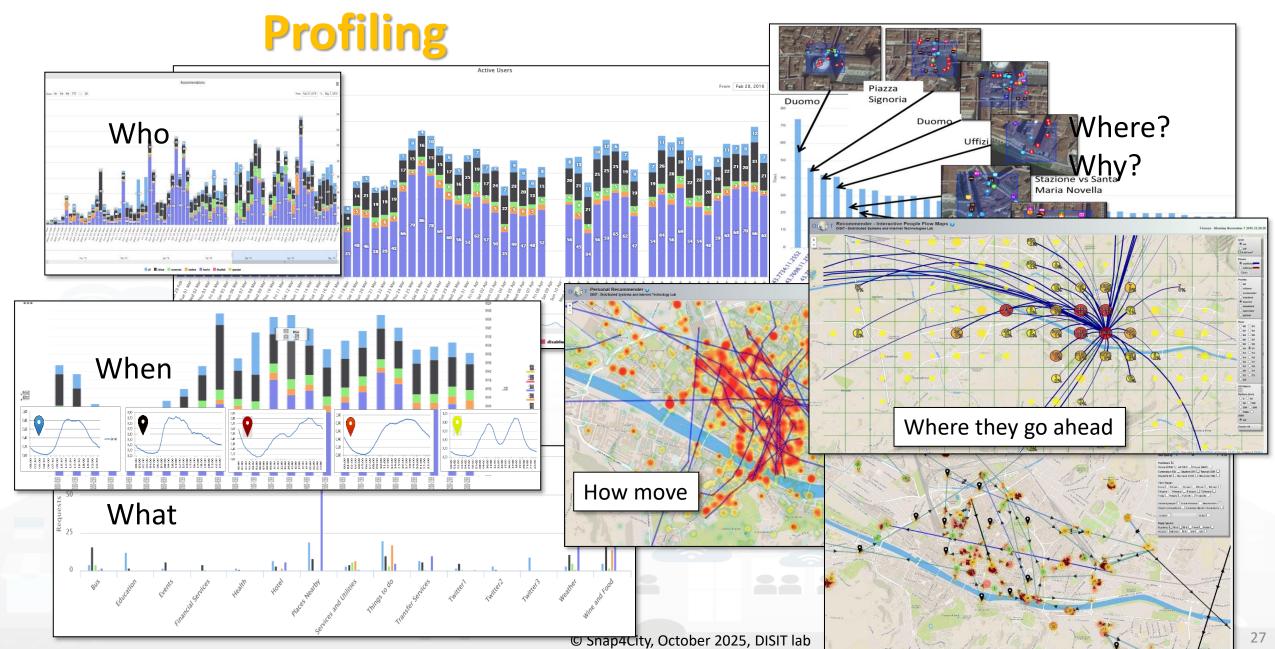






User Behavior Analyser for Collective























To propose suggestions and Engage city user we need to know how they are moving













Smart Retail



Feedback Project:

- Flexible Advanced Engagement Exploiting User Profiles and Product/Production Knowledge
- VAR, PatriziaPepe (Tessilform), DISIT, SICE
- Keywords: retail, GDO, ...

Goals and drivers:

- adaptive user engagement, customer experience
- Advanced user profiling, user behaviour analysis
- IOT and instrumentation
- Predictive models for engagement
- Integrated in city customer experience

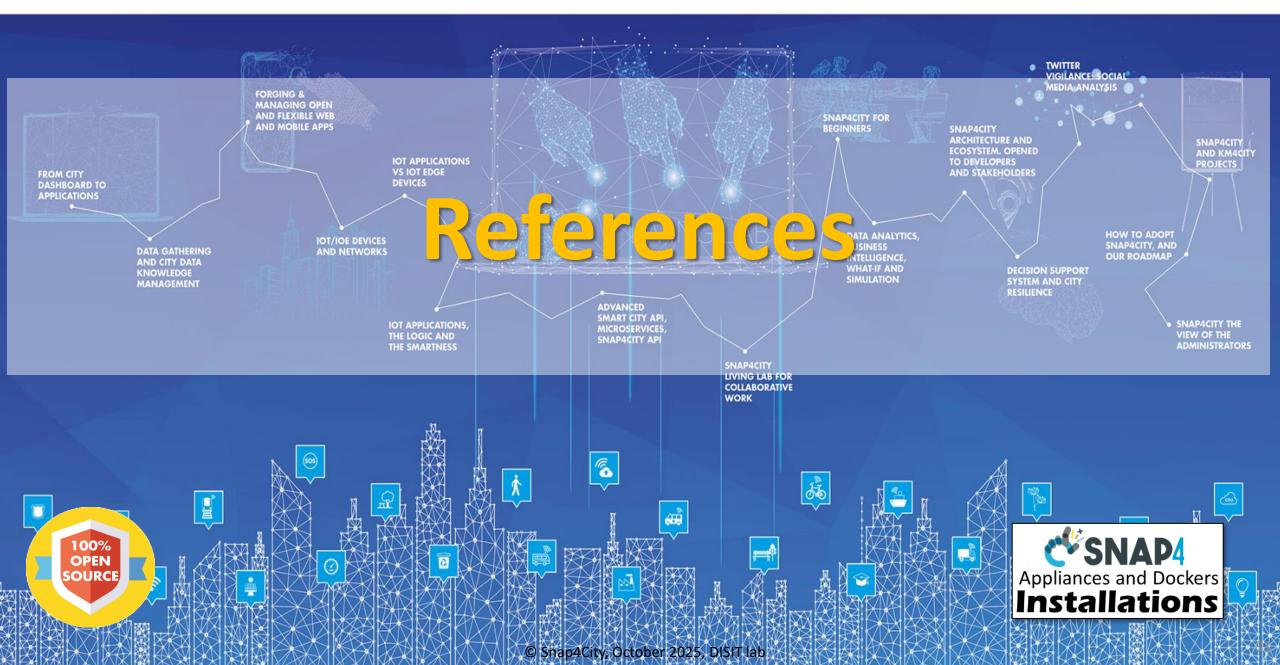
feedback

Aiming to solve current State of the Art issues:

- Cold start problems in generating recommendations for new users, also addressing seasonality of products and items
- GDPR compliance







booklets

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





TOURISMO EURO MED

TOURism Innovative and Sustainable Management of flOws





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



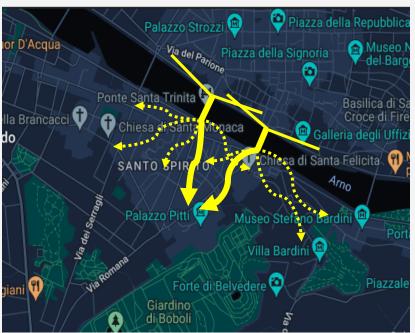




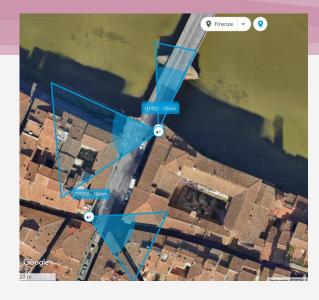


Florence (Italy) – Scenario: City Centre









Anticipate and mitigate negative or unexpected unknown events, predict flows and virtuously orient them

Equipment:

- 2 Thermal cameras3 Pax counters: sniffer
- counting devices



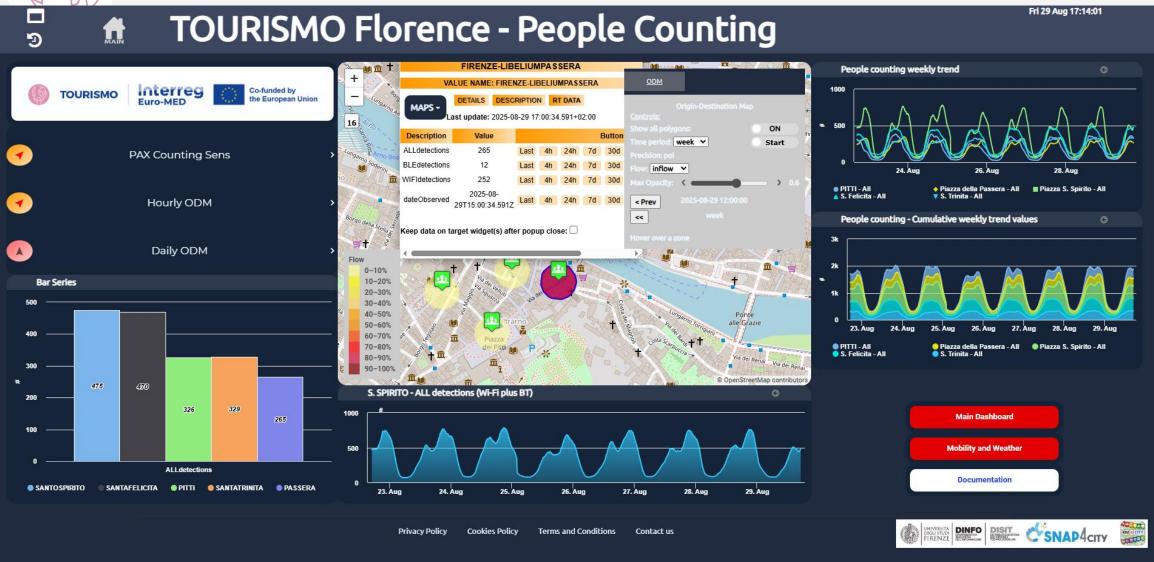








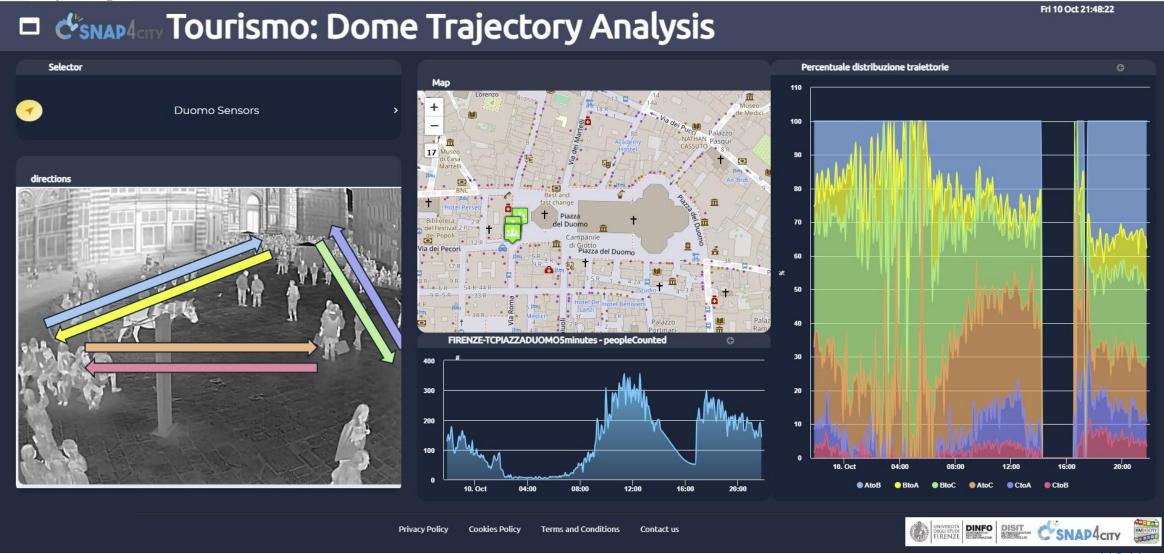


















Malta – Scenario: Golden Bay



Target: Visitor behaviour analysis at the Golden Bay, with the intention of proposing a carrying capacity limit during peak seasons for conservation policy recommendations.

Equipment:

- 2 Thermal Cameras
- 4 Pax counters
- 1 Traffic counter







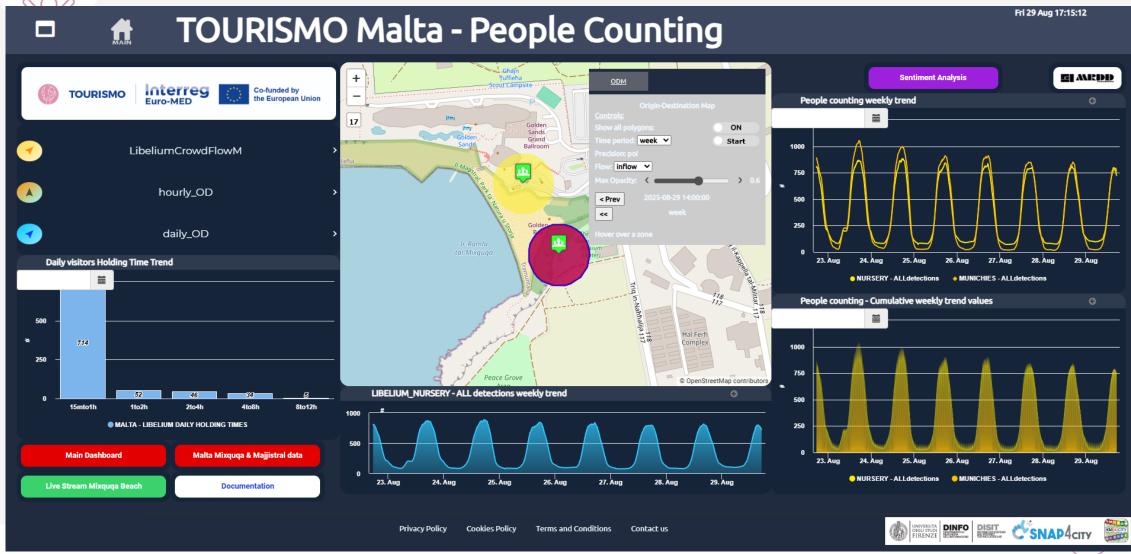


















Varna (Bulgaria) – Scenario: City Centre







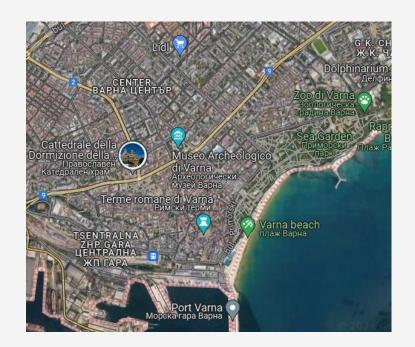








Varna (Bulgaria) – Scenario: City Centre



Equipment: Drones: people flows images during the day

<u>Target:</u> Data collection and processing of the tourists' flows in key locations of the city of Varna to analyse crowd density and queue formations















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









Valencia (Spain) – Scenario: Valencia Port















Valencia (Spain) – Scenario: Valencia Port



Target:

Anticipate and develop methods to analyse the situation regarding the flow of cruise tourists, identify trends, and manage the tourist flows to prevent future overcrowding.

Equipment:

- 2 Thermal cameras
- 3 Pax counters •













Valencia (Spain) – Scenario: Historic City Centre















Valencia (Spain) – Scenario: Historic City Centre



Target:

Monitor the impact of tourism on the architectural heritage of Valencia's historic centre: real-time occupancy in La Lonja and in the Museum of the City (Palacio del Marqués de Campo)

Equipment:

Indoor pax counters: Entrance and exit sensors in the buildings













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









Croatia - Scenario: Island of Biševo



<u>Target:</u> Achieve sustainable tourism on the islands of Biševo and Komiža by covering the flow of guests entering the famous 'Blue cave' on Biševo island.

Equipment:

2 Pax counters: sniffer counting devices























Rhodes (Greece) – Scenario: Medieval city







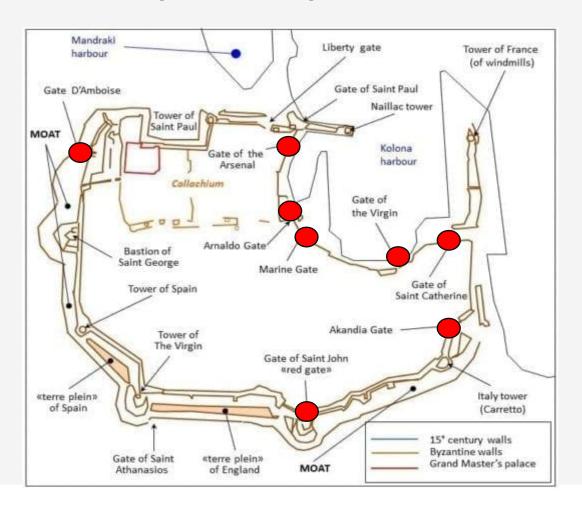








Rhodes (Greece) - Scenario: Medieval city



Target:

Medieval City's carrying capacity by comparing the data from higher and lower tourist seasons

Equipment:

 8 Thermal cameras, one for each gate of Medieval City



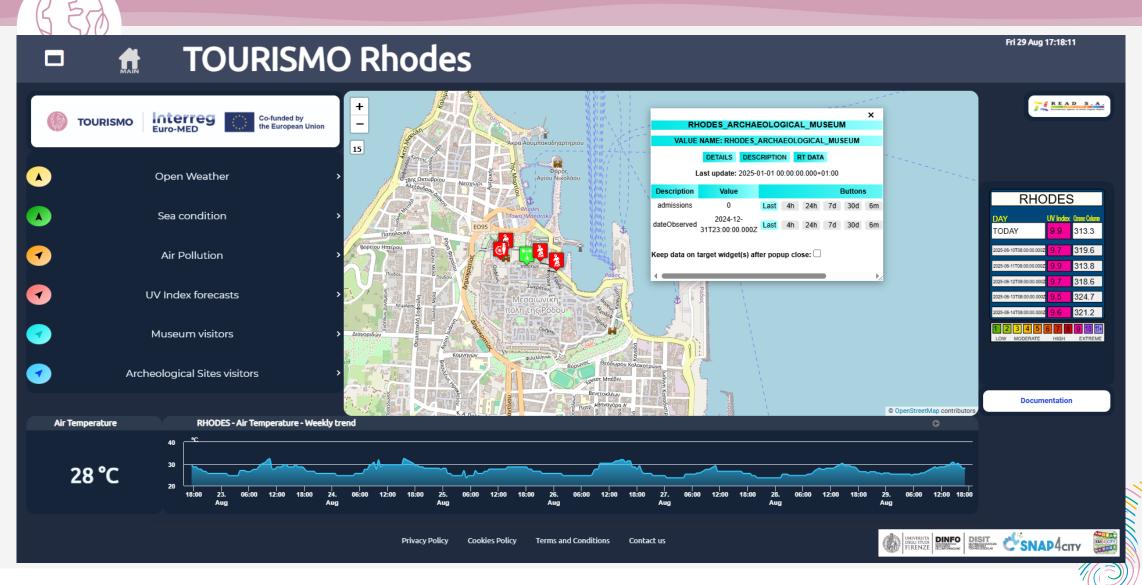










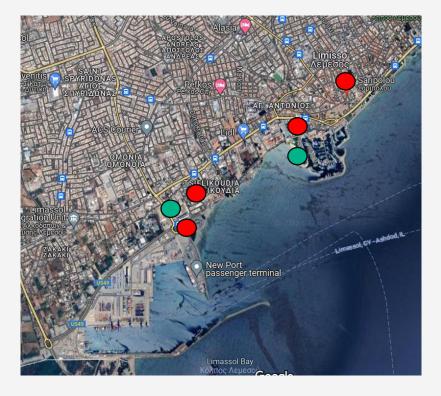






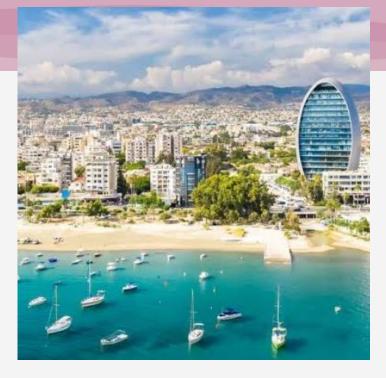
Cyprus Scenario:

Limassol Port



Target: Measure and Analyse the Tourist flow within Old port of Limassol and Port of Limassol. Understand the patterns of tourist movement and behaviours.





Equipment:

4 Thermal cameras ● 10 Pax counters ●



























CITY



INDUSTRY









PTIFaaS







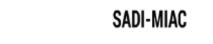


















Vama Economic Development Agency































































Be smart in a SNAP!





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