Snap4City

Tools for rapid implementation of
- Sustainable Smart Solutions
- Decision Support Systems
as a no-coding, low-coding
Big Data Analytics + Artificial Intelligence

• Aims
  • Increasing control, telecontrol and hyper-automation
  • Reduction of: Downtime, Costs (reducing waste), and Reaction Time to unpredicted events
  • Increment of Product Quality, Control, process understanding

• By Means
  • Data aggregation, modelling, integrating and exploiting data of
    • Digital Twin, IoT Brokers/Edge, SCADA, MES, ERP, DCS, Admin Data, BIM, Ticketing, etc.
    • Ontology and semantic reasoner for the industry plant
  • Data Analytics: from descriptive to prescriptive
  • Decision Support Systems, DSS
    • Simulation, Visual Analytics, Data Analytics, Synoptics
    • XAI on predictions, anomaly detection (early warning), classifications
    • What-if Analysis: simulation + AI predictions + decision support

• Large Scale Integration
• Security, GDPR, etc.

to cope with
• any data, format
• any channel, protocol
• any AI/ML
• any place
• online development
• multi-tenant
• Secure, PENTest
• GDPR, privacy
  • \(\rightarrow\) low costs
  • \(\rightarrow\) easy to evolve
Tools for rapid implementation of sustainable Smart Solutions and Decision Support Systems

www.snap4city.org

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4City Compliant Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

E015 digital ecosystem

EXPERT SYSTEM KNOWLEDGE BASE STORAGE

BIG DATA ANALYTICS EXPLAINABLE ARTIFICIAL INTELLIGENCE BUSINESS INTELLIGENCE MACHINE LEARNING

DATA FLOWS, DATA DRIVEN WORKFLOWS, MICROSERVICES PARALLEL DISTRIBUTED PROCESSING

METHODOLOGIES COURSES AND COMMUNITY LIVING LABS DEVELOPMENT TOOLS

PREDICTION - ANOMALY DETECTION - ENVIRONMENTAL MODEL - 3D MODEL KPI - SIMULATION - EARLY WARNING - SYNOPTIC - DIGITAL TWIN - VIRTUAL REALITY
Data Type Coverage

- POI, IOT, shapes,..
- maps, orthomaps, GTFS, GIS
- WFS/WMS, GeoTiff,..
- calibrated heatmaps,..
- traffic flow, typical trends,..
- trajectories, events,..
- 3D, BIM, Workflow,..
- Dynamic icons/pins,..
- OD Matrices, scenarios,..
- prediction models,....
- decision support,....
- Synoptics, animations,..
- social media, Routing,..
- Satellite data,..
- KPI, personal KPI,..
- etc.
Standards and Interoperability (2021)


https://www.snap4city.org/65
Expert System semantic queries

• via:
• Smart City API for Apps and third party
• MicroServices data driven develop via visual language Node-RED

https://www.snap4city.org/19
Almost no coding platform

- IoT App Visual Programming, no coding
  - Data transformation
  - Integration
  - Scripting Data Analytics
  - Data ingestion
  - Business logic
- MicroServices data driven develop via visual language Node-RED

ETE, October, Snap4City Overview, 2021
Fast to realize reliable & secure Solutions

• 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
2021/10: Snap4City Numbers

• > 120 Protocols
• Mobility, energy, people flow, environment, Industry 4.0, tracking, smartbed, smart ambulance, Tourism, smart light, culture, etc...
  • 6 running installations
  • 13 projects, 12 pilots on 9 Countries
• On the largest deploy
  • 17 Organizations / tenant
  • > 4800 users on https://www.Snap4City.org
  • > 1300 Dashboards
  • > 15 mobile Apps
  • > 2 Million of structured data per day
  • > 550 IoT Applications/node-RED /Docker
  • > 680 web pages with training
  • > 140 videos, training videos

Main Organizations/areas
• Antwerp area (Be)
• Capelon (Sweden: Västerås, Eskilstuna, Karlstad)
• DISIT demo (multiple)
• Dubrovnik, Croatia
• Firenze area (I)
• Garda Lake area (I)
• Helsinki area (Fin)
• Livorno area (I)
• Lonato del Garda (I)
• Modena (I)
• Mostar, Bosnia-Herzegovina
• Pisa area (I)
• Pont du Gard, Occitanie (Fr)
• Roma (I)
• Santiago de Compostela (S)
• Sardegna Region (I)
• SmartBed (multiple)
• Toscana Region (I), SM
• Valencia (S)
• Venezia area (I)
• WestGreece area (Gr)

Last minute:
- Installation in Israel
- Coverage of all Greece is coming
Smart City Control Room
Florence Metropolitan City

- **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
Mobility and Transport
Traffic Flow Analysis

• Multiple Domain Data
  • Traffic Flow sensors, city structure, weather
• Decision Makers Multiple Locations
  • Real time Monitoring, predictions
  • Traffic Flow Predictions,
  • Traffic Reconstructions, routing
  • Dashboards, What-IF analysis
  • Mobile App, people flows
• Historical and Real Time data
• Services Exploited on:
  • Dashboards, Mobile App
• Since 2017, 2019
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**
People Monitoring on Pub Services
DIGIPOLIS Antwerp

- Multiple Domain Data
  - PAX Counters: museum, pub services, COVID-19

- Multiple Levels & Decision Makers
  - Business Intelligence Dashboards
  - People flow, OD flows
  - Detection of critical conditions

- Historical and Real Time data
  - 20 fixed PaxCounters
  - 2 Mobile PaxCounters

- Services Exploited on:
  - Dashboards, Mobile Apps, API/data
  - Fully Controlled Devices by Digipolis

- Since 2019
Impact of COVID-19

- Multiple Domains Data
  - Traffic, environment, People, parking, stock options, Twitter, etc.

- Decision Makers Multiple Locations
  - NO2 long term predictions
  - Twitter analysis

- Historical and Real Time data

- Services Exploited on:
  - Dashboards
  - Social media,
  - Sentiment Analysis

- Since 2019, 2020

ETE, October, Snap4City Overview, 2021
Smart Light Control of **CAPELON**

- **Energy Domain**
  - Smart Light, MQTT, ....
  - IoT Orion Broker FIWARE

- **Dashboards**
  - Map coverage on Sweden
  - Monitoring and real time control
  - Energy control, analytics
  - Direct control

- **Historical and Real Time data**

- **Services Exploited on:**
  - Multiple Levels, API
  - Dashboards

- **Since 2020**
Dubrovnik

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

- Since 2020
West Greece

• Tourism Domain
  - KPIs: ODM, Flows, ...
  - Social Media
  - People Flows

• Dashboards
  - Monitoring KPI
  - People flows
  - Twitter Vigilance

• Historical and updated data

• Services Exploited on:
  - Dashboard

• Since 2020
Helsinki, Finland

• Dashboards & Services:
  • Environment & Weather, PM10, PM2.5, NO, SO2, CO, noise, etc.
    • Sensors values, Heatmap & Alerts on critical
    • FMI Enfuser prediction: PM10, PM2.5, ..
    • GRAL predictions PM10, validations
    • Private sensors in Jätkäsaari area (personal dashboards)
  • Mobility: Traffic Sensors, Operators, routing, multimodal routing, whatif
  • Social: Twitter Vigilance, early warning
  • Life in Helsinki: OD matrix people flow, Twitter Vigilance SA, hot places, etc.
  • Tourism and Culture

• Mobile App and MicroApplications:
  • Helsinki in a Snap (all stores)

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

15MinCityIndex on Bologna

15 minutes index – Bologna Città Metropolitana (beta)


ETE, October, Snap4City Overview, 2021
ETE, October, Snap4City Overview, 2021
• Big Data Analytics
• Semantic Computing
• Machine Learning
• Explainable Artificial Intelligence
• Deep Learning
• Geo Spatial Reasoning
• Text Analysis, Sentiment Analysis
• What If Analysis
• Simulations
• Visual Analytics
• Engagement Analysis
• ....
Traffic Flow Reconstruction for the cities

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==
Analysis of
• **Demand** of Mobility
  – Via OD matrices
  – POI, city structure, etc.

With respect to
• **Offert** of Transportation:
  – Public services
  – Private services
  – Multiple agencies
  – GTFS

Critical Busses, busstops, paths, rides, etc.

https://www.snap4city.org/odanalyzer/#b
Traffic Flow Manager on multiple cities

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

ETE, October, Snap4City Overview, 2021
What-if Analysis

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

ETE, October, Snap4City Overview
Snap4BIM: from 3D model to real time data
3D Multi Data Map - Digital Twin Global - Firenze

demonstrator

Thu 16 Sep T17:56:49

360
Origin Destination Matrix Estimation

Wi-Fi based
Early Warning
Twitter Vigilance and Water Bomb

Florence downburst

Stazione Firenze Universita' - Firenze (T1): 04,04 m

Twitter Vigilance
DISIT Lab, Distributed Data Intelligence and Technologies

Department of Information Engineering (DINFO)

http://www.disit.dinfo.unifi.it
http://www.disit.org

PCP Award

Roadmap

Twitter Vigilance - Social Media Analytics, Sentiment Analysis

User engagement

Bike Sharing

Data Analytics ++

Social Predictions

OBD2

Sardinia Region Smart City Strategies and plan

Smart Energy

Sustained Mobility

Control Room

Dashboard

Origin-Destination and trajectories

Traffic Reconstruction

Offer Analysis

OBU, smart devices

- Tuscany, Road Graph
- Mobility
- culture, tourism
- Events
- Parking
- Services
- Linked open graph

- Weather Forecast
- Real Time Wi-Fi
- Entertainment
- LOD

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

- Infomobility
- Mobile App
- Routing
- Multimodality

- Sardinia Region Smart City Strategies and plan

- Resilience Decision Support
- Smart First Aid
- User Behaviour Analysis, predictions
- Risk Analysis

- IoT/IOE, IOT App
- Living Lab
- Maker Support
- IOT Edge
- Smart City IOT
- GDPR,
- Privacy & Security

- Smart Waste

2013

Km4City Ontology 1.1

H2020

(2016-21)

2014

SII-MOBILITY SCN

(2016-21)

2015

Km4City 1.4

H2020

(2015-18)

2016

FIWARE

2017

GREEN IMPACT

PDR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

2018

GHOST SIR

2019

IOT/IOE

Km4City 1.6.6

H2020

(2017-19)

2020

MOSAiC

(2018-21)

5G tech Energy Industry 4.0 Synoptics

ICOS

5G tech

Energy Industry 4.0

Synoptics

DISIT lab roadmap vs model and tools’ usage

Winner of Select4Cities PCP

Winner of Select4Cities PCP

Km4City 1.5

Km4City 1.6.2

Km4City 1.6.4

2018

5G tech

Energy Industry 4.0

Synoptics

2019

IOT/IOE

SII

MOBILITY SCN

(2016-21)

2020

H2020

(2017-19)

H2020

(2018-20)

H2020

(2018-21)

H2020

(2018-21)

CEF

(2018-21)

SMART CITY

SELECT4CITIES

WINNER OF

SELECT4CITIES

PCP

GREEN IMPACT

- Industry 4.0
- Critical Plant
- Monitoring

- IoT/IOE, IOT App
- Living Lab
- Maker Support
- IOT Edge
- Smart City IOT
- GDPR,
- Privacy & Security

- Smart Waste

2019

Green Field Peas Sodad.0

Resilience Decision Support

Smart First Aid

User Behaviour Analysis, predictions

Risk Analysis

2013

Km4City Ontology 1.1

H2020

(2016-21)

2014

SII-MOBILITY SCN

(2016-21)

2015

Km4City 1.4

H2020

(2015-18)

2016

FIWARE

2017

GREEN IMPACT

PDR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

2018

GHOST SIR

2019

IOT/IOE

Km4City 1.6.6

H2020

(2017-19)
IEEE ITSS – Italian Chapter & DISIT LAB of Università di Firenze present

IEEE Intelligent Transportation Systems Snap4City Hackathon

https://www.snap4city.org/757
## On Line Training Material (free of charge)

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<td>General</td>
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<td>Data Ingestion processes</td>
<td>System and Deploy Install</td>
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[https://www.snap4city.org/577](https://www.snap4city.org/577)
Overview

Overview

- April 2021
Snap4City

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

- 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