Verso la Conferenza Internazionale di Cartografia Firenze ICC2021

3° Workshop

Geo Open Data: opportunità e nuove sfide per i professionisti, le aziende e la Pubblica Amministrazione

Università degli studi di Firenze, DINFO, DISIT Lab, Snap4City

Paolo Nesi

Paolo.nesi@unifi.it

Sommario

• Chi Siamo: DISIT Lab, Snap4City
• Cosa facciamo
• Le sfide
• Le innovazioni

DISIT Lab ha bandito
- 2 Assegni di ricerca per 2 anni → PhD
- 1 Borsa del dottorato nazionale in AI per 3 anni
https://www.snap4city.org/581
Cosa Facciamo

Smart City: Urban Platform
- Which should not be confused with Open Data Platform

Industry 4.0

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

any data, format
any channel, protocol
any AI/ML
any place
online development
multi-tenant
Secure, PENTest
GDPR, privacy
⇒ low costs
⇒ easy to evolve
DASHBOARDS AND APPS - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS

EXPERT SYSTEM KNOWLEDGE BASE STORAGE

BIG DATA ANALYTICS ARTIFICIAL INTELLIGENCE BUSINESS INTELLIGENCE MACHINE LEARNING

DATA FLOWS, WORKFLOWS MICROSERVICES MANAGEMENT

METHODOLOGIES COURSES AND COMMUNITY LIVING LABS DEVELOPMENT TOOLS

Snap4City Overview, 2021
Ingestion, agg. ⇒ exploitation

- **Snap4City** efficient tools for:
  - Bidirectional data channels
  - Any format, any channel, any data, any broker, any protocol, ...

- **Km4City** Knowledge base Ontology reasoning on geo, space, time, relationships
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
Ingestion, agg. → exploitation

- 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
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
Big Data Analytics + Artificial Intelligence

• Short and Long terms predictive models:
  • traffic, parking, people flow, maintenance,
• Traffic Flow reconstruction
• 3D Flow prediction: Pollutant (NOX, NO2, ...)
• Constrained Routing
• What-IF analysis (simulation + AI + data)
• ...
• Based on several computational models:
  • trajectories, OD matrices, Typical Time Trends, etc.
2021: Snap4City Numbers

• > 100 Protocols
• Mobility, energy, people flow, environment, Industry 4.0, tracking, smart bed, smart ambulance, Tourism, smart light, culture, etc...
  • 5 running installations
  • 13 projects, 12 pilots on 9 Countries

• On the largest deploy
  • 17 Organizations / tenant
  • > 4800 users on https://www.Snap4City.org
  • > 1200 Dashboards
  • > 15 mobile Apps
  • > 2 Million of structured data per day
  • > 500 IoT Applications/node-RED /Docker
  • > 680 web pages with training
  • > 40 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
- Training in Japan in July
- Coverage of all Greece is coming
Florence

- **Multiple Domain Data**
  - **Context**: Thousands OD, POI, IOT, etc.
  - **mobility and transport**: accidents, public transport, parking, traffic flow, Traffic Reconstruction, KPI, ...
  - +++: environment, civil protection, gov KPI, covid-19, social & social media, people flow, tourism, energy, ...

- **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**
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

Cities: Firenze, Pisa, Livorno, Modena, Santiago di Compostela

reference
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
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

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<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging period</th>
<th>Objective and legal nature and concentration</th>
<th>Comments</th>
<th>Concentration</th>
<th>Comments</th>
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<td>One day</td>
<td>Target value, 25 µg/m$^3$</td>
<td>The target value has become a limit value since 1 January 2020</td>
<td>10 µg/m$^3$</td>
<td>90th percentile (2 days/year)</td>
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<tr>
<td>PM$_{2.5}$</td>
<td>One day</td>
<td>Limit value, 50 µg/m$^3$</td>
<td>Not to be exceeded on more than 35 days per year</td>
<td>50 µg/m$^3$</td>
<td>90th percentile (3 days/year)</td>
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<tr>
<td>NO$_x$</td>
<td>Calendar year</td>
<td>Limit value, 40 µg/m$^3$</td>
<td>Not to be exceeded on more than 15 days per year, averaged over three years</td>
<td>10 µg/m$^3$</td>
<td>100 µg/m$^3$</td>
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<tr>
<td>CO$_2$</td>
<td>Maximum daily 8-hour mean</td>
<td>Target value, 120 µg/m$^3$</td>
<td>Not to be exceeded on more than 10 times a calendar year</td>
<td>200 µg/m$^3$</td>
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<td>Calendar year</td>
<td>Limit value, 40 µg/m$^3$</td>
<td></td>
<td>40 µg/m$^3$</td>
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</tr>
</tbody>
</table>
• Multiple Domain Data
  • Smart Parking, Environment, Wi-Fi

• Multiple Decision Makers
  • City Officer, operators
  • Data monitoring, alerting
  • analytics

• Historical and Real Time data
  • Dashboards

• Services Exploited on:
  • Dashboards, API

• Since 2019
Smart Light Control of Capelon

- Energy Domain
  - Smart Light
  - 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
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
Sommario

• Chi Siamo
• Cosa facciamo
• Le sfide
• Le innovazioni
Le sfide si superano ogni giorno

• Interoperabilità
  • Moltitudine di protocolli e formati, new standards
  • Integrazione con sistemi legacy di ogni tipo
• Gestione di innumerevoli tipi di dati diversi oltre il GIS
• Automating the data ingestion
• Sicurezza \(\rightarrow\) PEN Test
• Privacy \(\rightarrow\) GDPR
• Scalabilità ...
• Modularità ...
• ...
Standards and Interoperability (2021)


https://www.snap4city.org/65
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.
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https://www.snap4city.org/581
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.

Traffic Flow Manager on multiple cities

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzEyNg==
Digital Twin Local, 3D vs Real Time Data
What-if Analysis

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

Public Services

Traffic Flow

Routing
3D Map beta Testing

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM2MA==#
Workflow for Ticket management

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

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

Consumptions/productions

Events/actions

Business Intelligence Maintenance

Dashboards and actions
## On Line Training Material (free of charge)

<table>
<thead>
<tr>
<th>Part</th>
<th>What</th>
<th>1st part (*)</th>
<th>2nd part (*)</th>
<th>3rd part (*)</th>
<th>4th part (*)</th>
<th>5th part (*)</th>
<th>6th part (*)</th>
<th>7th part (*)</th>
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<tr>
<td>1st part</td>
<td>General</td>
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<td>2nd part</td>
<td>Dashboards</td>
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<td>3rd part</td>
<td>IOT App, IOT Network</td>
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<td>4th part</td>
<td>Data Analytics</td>
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<td>5th part</td>
<td>Data Ingestion processes</td>
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<tr>
<td>6th part</td>
<td>System and Deploy Install</td>
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<tr>
<td>7th part</td>
<td>Smart City API: Web &amp; Mob. App</td>
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### Interactive Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Video1</th>
<th>Video2</th>
<th>Video3</th>
<th>Video4</th>
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Overview


Overview

• April 2021

• https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview-April-2021-V5-3.pdf
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