Current, planned and envisaged activities of the Municipality of Milano in the sector of City Digital Twins

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Agenda

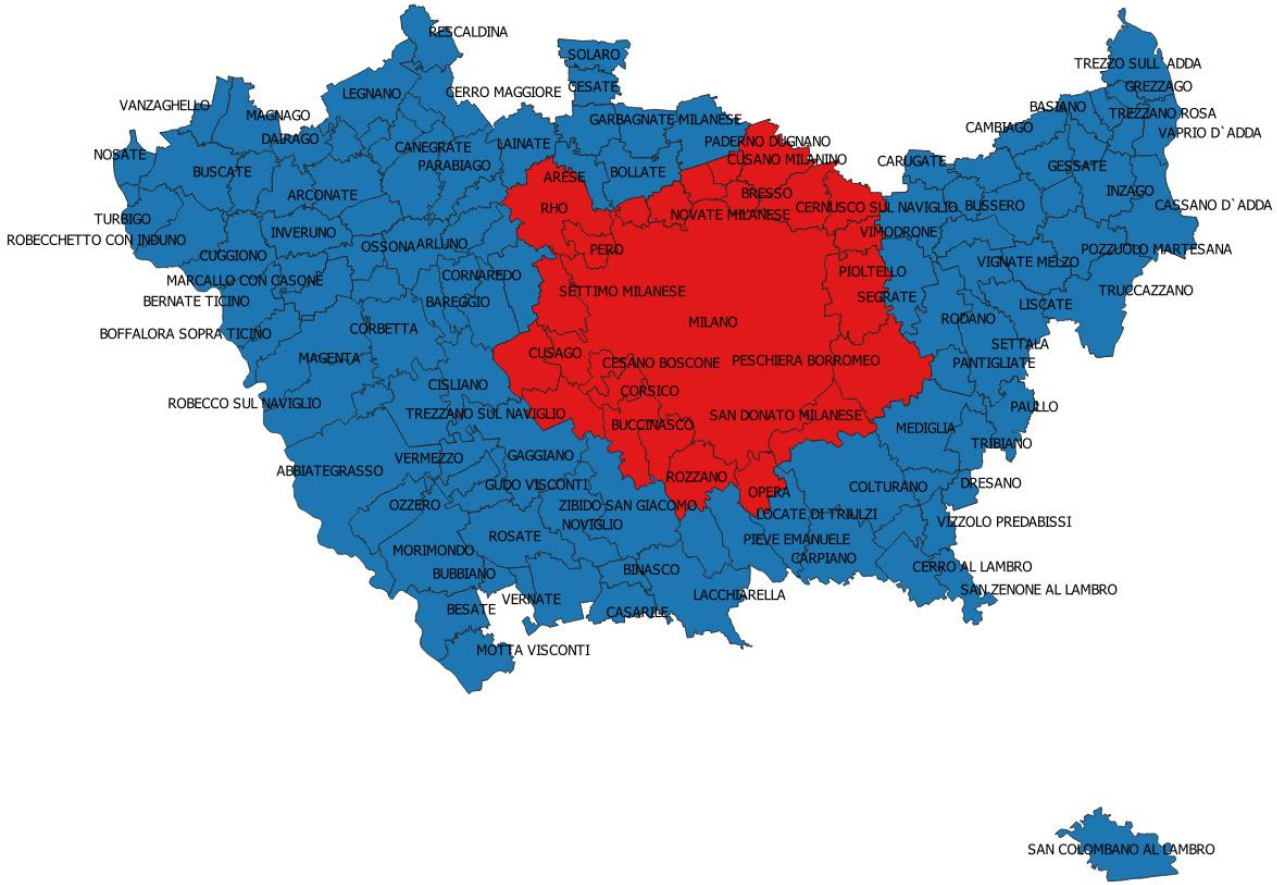
University of Pavia and Municipality of Milano are collaborating for a large and innovative project on urban digital twin.

- Description of the current activities
- The already-planned applications of the city digital twin
- The vision for the future and the roadmap
- What we can offer to new initiatives

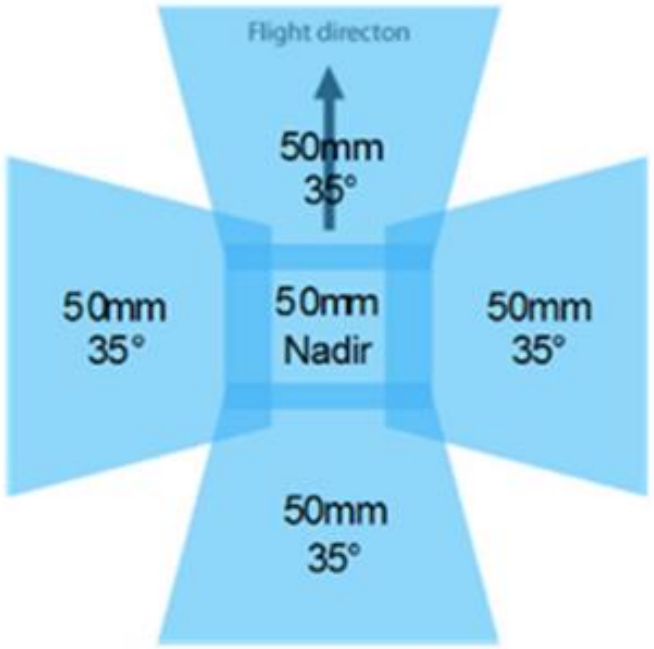
Current activities

Aerial survey

- Acquisition of nadir and oblique imagery having ground resolution of 5 cm
- Capture of lidar data having density of 20 pt/m^2
- Total size of the area: 1776 sq km
- Municipalities: 133
- Camera adopted: Leica City Mapper - 2



Leica City Mapper 2 - 2



- Hybrid sensor
- Nadir images
- Oblique images

- Lidar data
- Four channels: R, G, B and NIR

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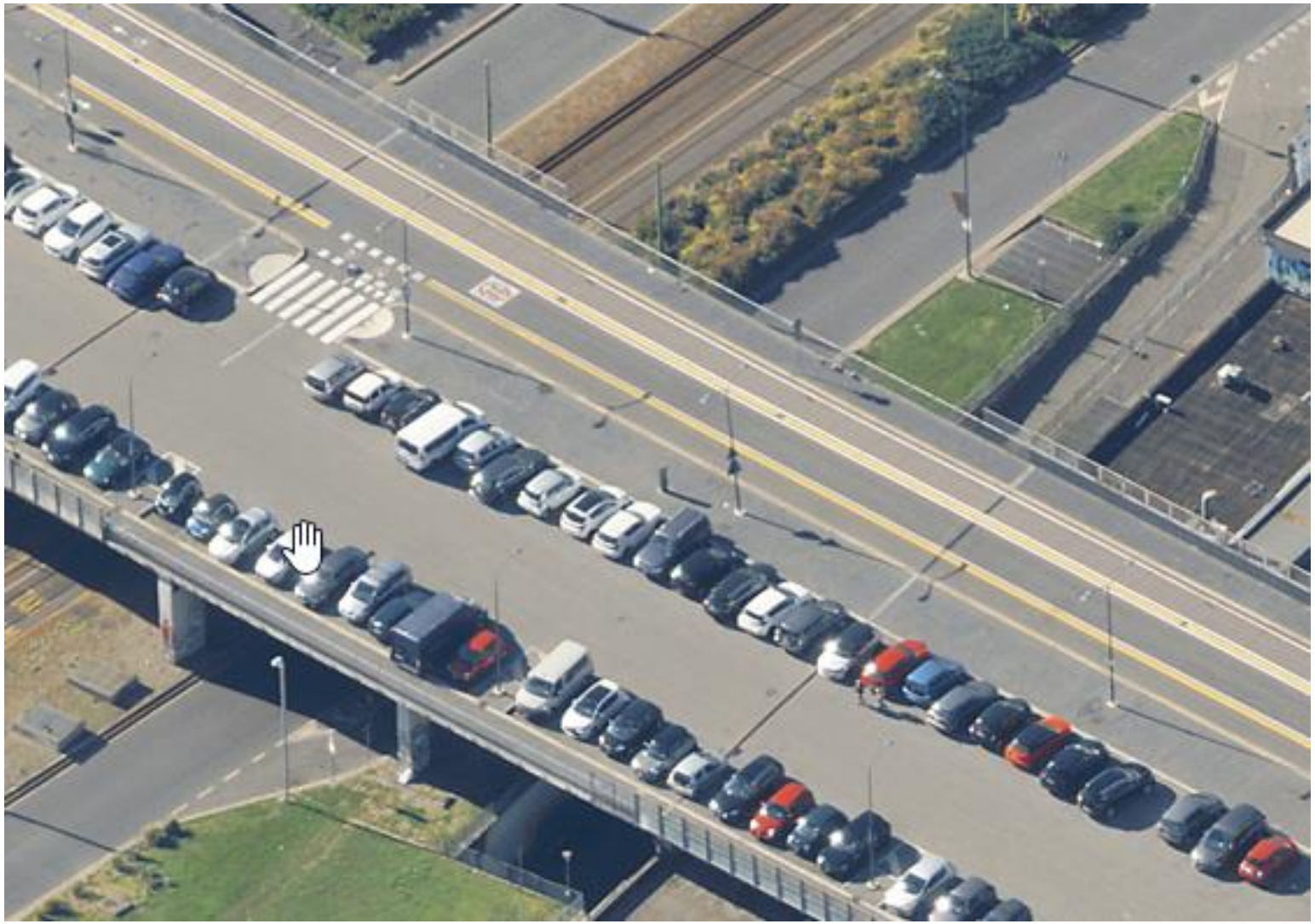
Milano, the Gae Aulenti square - 1



Milano, the Gae Aulenti square - 2

Digital terrain models

Ground MMS surveying

- MMS survey of all the roads of the municipality of Milano, having total length of 2600 km
- Backpack integrations for areas where car entrance is forbidden
- Minimal lidar point density: 1500 pt/m^2 to be tested on a regular and vertical surface, parallel to the car's travelling direction, located at a distance of 10 m from the sensor
- Image resolution: GSD <=8 mm to be tested on a vertical surface, parallel to the car's travelling direction, located at a distance of 10 m from the sensor

Sensori per l’acquisizione da terra - MMS

- 5 camere
- Lidar
- GNSS
- IMU
- Elettronica di supporto

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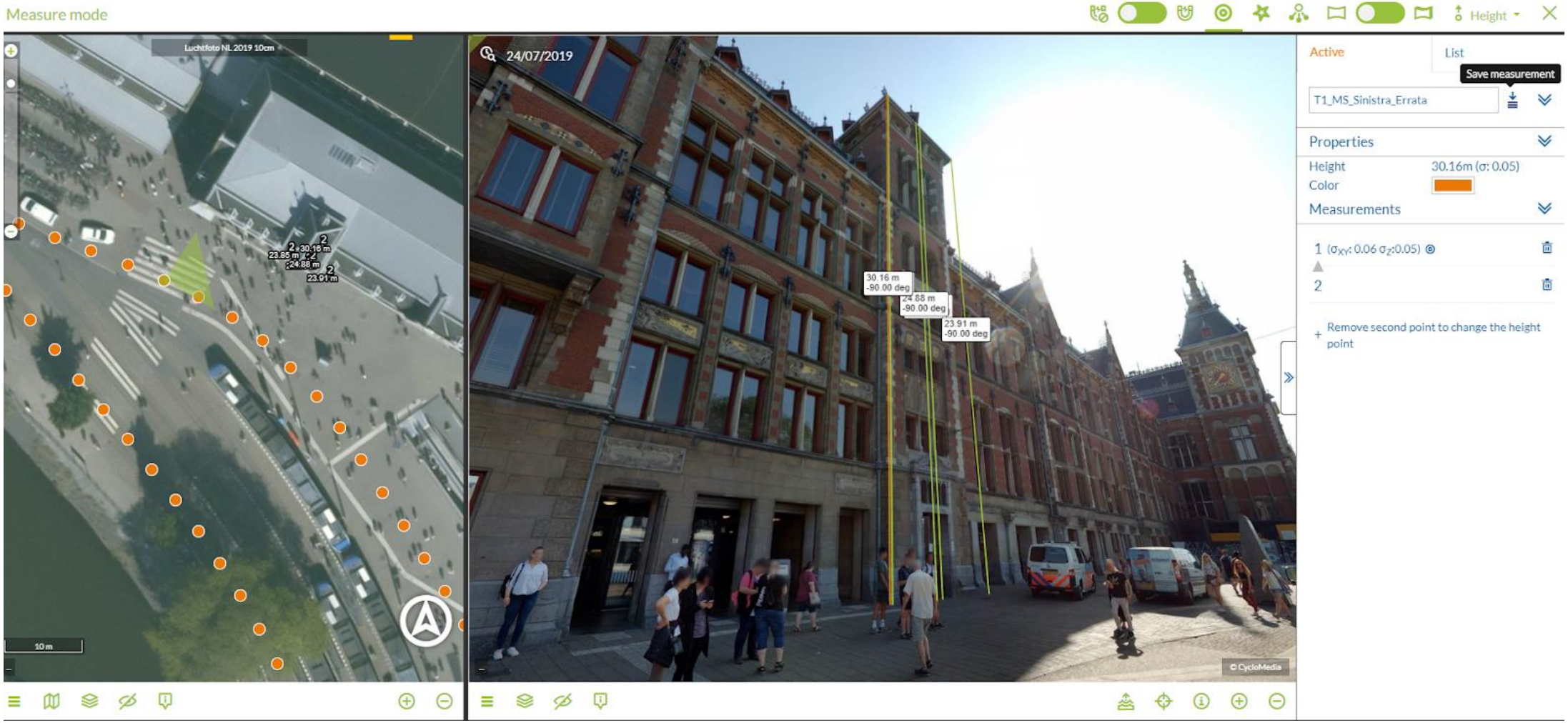
Main products of MMS surveying

- Accurately georeferenced spherical RGBD images (depth images, having four channels, R, G, B and depth); spacing between two images: 5 m
- Database tables related to around 22 *objects* such as: traffic lights, streetlights, booths, newsstands, road signs, road markings, showcases, bus stops, bus shelters, etc; total number of the objects: 1.2 millions
- Their identification and measurement highly rely on artificial intelligence

Modelli navigabili e rigorosamente misurabili



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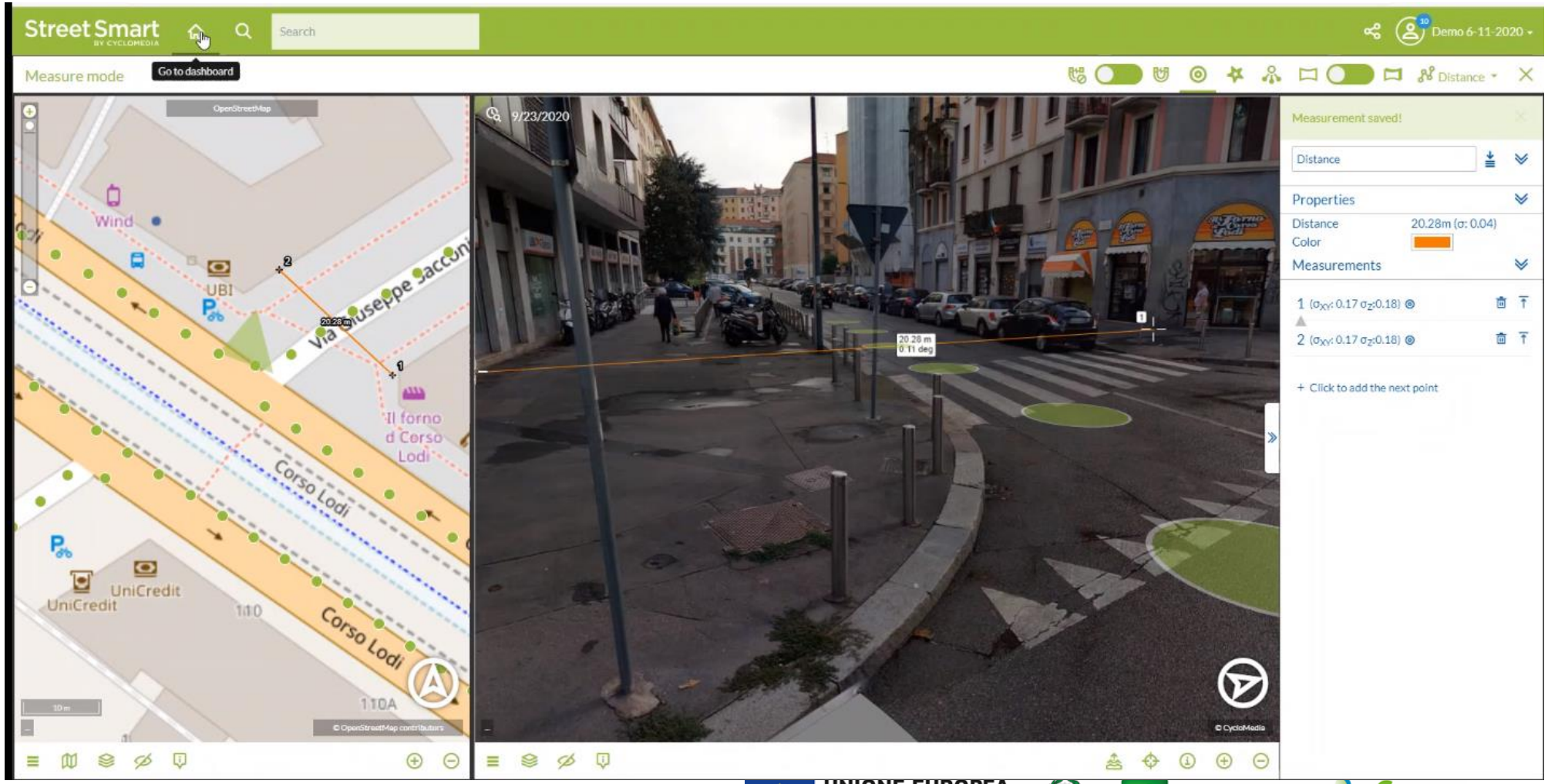
Modelli navigabili e rigorosamente misurabili - 2



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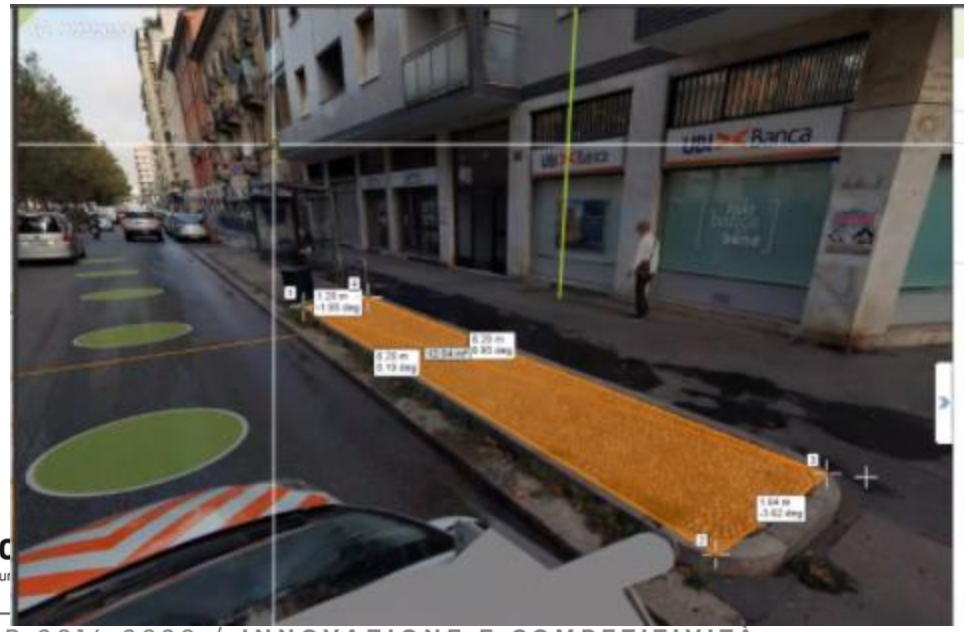
Dettaglio molto elevato



Planned applications

Motivations

- The project is part of an ongoing, long-term effort of the municipality of Milano aiming at a better, deeper and timely knowledge of the territory
- Main motivations and goals of the current project
  - To better perform the usual applications based on 2.5D spatial databases
  - To create an advanced database of street furniture: 22 categories, 1.2 million objects
  - To better manage some processed (events' management, tax enforcement) by implementing the digital twin paradigm. Thanks to the recovered taxes, the project will be self-funded
  - To focus on sustainability and, in particular, on the red/green roofs topic and on solar potential analysis
  - Inventory of green areas and trees' species, including private areas
  - Hydraulic risk modelling
  - To have a smarter Milano

Driveways

- You must be authorized by the municipality to put the sign; you have to pay taxes on it
- There is significant evasion, total or partial: size is underestimated
- How to check this? In the field? It’s expensive. Let’s move the city into the computer: digital twin approach.

Dehors, temporary events

- Dehors: as before
- Temporary events: authorization, taxes, conflicts with other activities

Green/red roofs; protected paths for unpaired people

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The roadmap

Il Gemello Digitale della Città

Sistema Informativo Territoriale del Comune di Milano

All what we mentioned plus interiors and undeground

True Ortophoto

MMV

Database Topografico

LiDAR aereo e terrestre

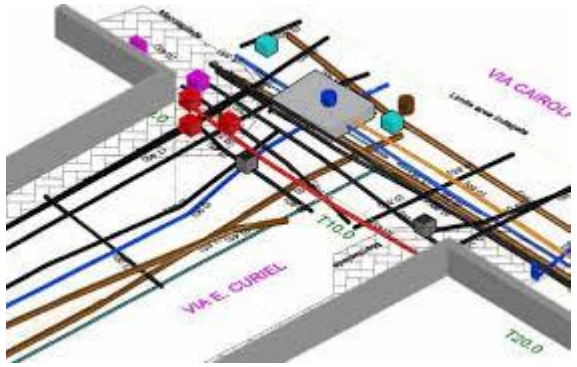
+

0,00

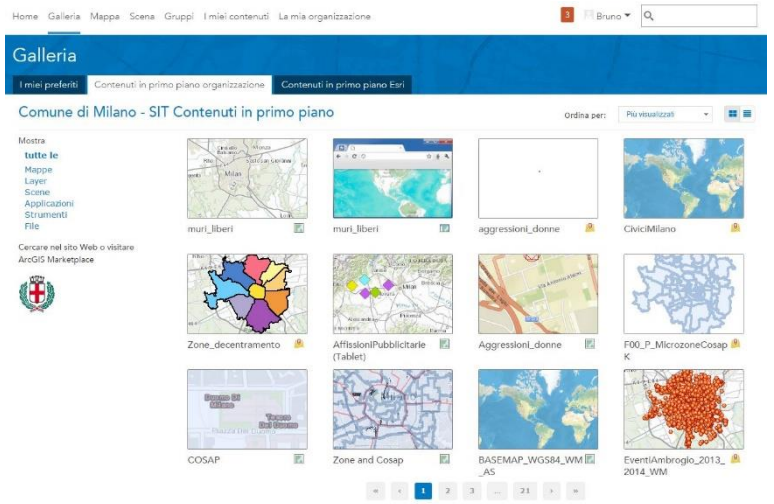
-

GIS Indoor & BIM

Database Sottosuolo



AS- Built



New data, updates and integrations

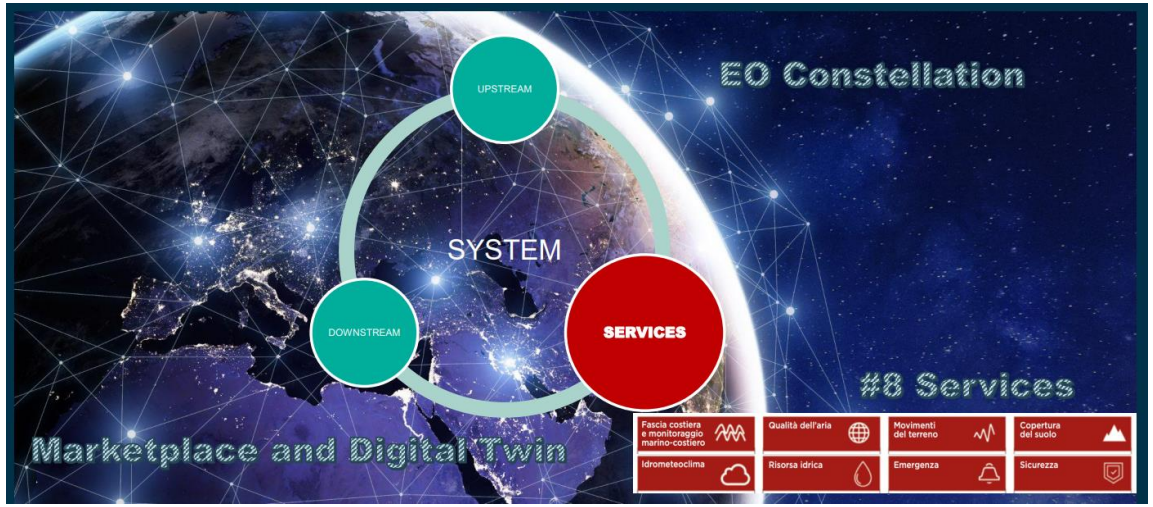
- Regular aerial lidar updates
- Mobile mapping terrestrial surveys of limited size areas which are quickly changing
- Satellite image, with high frequency and high resolution
- Surveying of interiors
- GIS&BIM integration

Satellite projects

I satelliti:

IRIDE PROJECT: Boostering Earth Observation in Local Public Administrations initiative

CEF SPOTTED "Satellite Open Data for Smart City Services Development"



esa

Spotted

Agenzia Spaziale Italiana

Our contribution to consortia and proposals

Our possibile contributions

- Milano
  - Test site
  - Guidance for replication
  - Host further developments
  - Exchange of experiences: problems met, solutions, ecc

- University of Pavia
  - Expertise in the acquisition, processing and check of the data
  - Experience on advanced methodologies for information extraction from points clouds and/or images, by means of photogrammetry and data science

Thanks for the attention