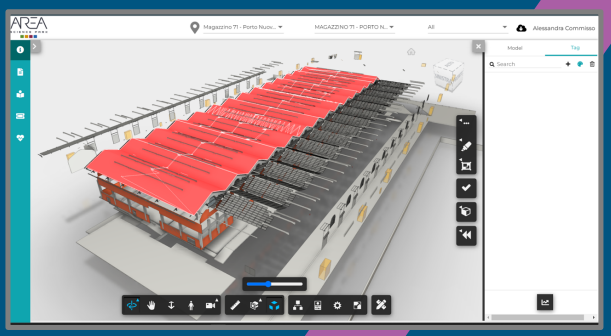
Truspace
Integrating possibilities

AREA SCIENCE PARK

Autorità di Sistema Portuale del Mare Adriatico Orientale
Porti di Trieste e Monfalcone

A *Digital Twin* pilot in the context of the port of Trieste



4Days

tre.digital

Real Comm
Easy for real

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Overview

Area Science Park, the promoting entity

The project was initiated by **AREA SCIENCE PARK**, a national research organization that has been working for more than four decades in the world of innovation, creating synergies between the research and business system, between the public and private sectors, in order to promote the development of territories.

Established as the management consortium of the Trieste Science and Technology Research Park, today the entity's main lines of action are: the **highly specialized research** in the fields of economic sciences, new materials and data science; the **innovation in support of the entrepreneurial system** through activities of technology transfer, valorization of research, and support for the generation of innovative enterprises; the **development of the science and technology park**, which to date hosts 64 settlements in its two campuses, including research infrastructures and centers of excellence of international significance. All of the institution's initiatives are geared toward supporting the ecological transition.

AREA SCIENCE PARK

Area Science Park's strategic **ARGO** project has the ambition to make Friuli Venezia Giulia a qualified and virtuous innovation laboratory of reference in the national and international arena through four projects:

1. the creation of the Port of Industrial Innovation in Trieste;
2. the creation of a network for the generation of highly innovative enterprises and the activation of a platform (IP4FVG) to support the digitization of enterprises on a regional scale;
3. the creation of scientific and technological platforms open to companies that want to work on innovation projects.

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Project

The project of Digital Twin in the port of Trieste: the partnership with the Port System Authority and the Port Community

In March 2022, in the context and scope of **ARGO**'s activities, the tender for the "*Design and implementation of an integrated solution for BIM modeling, sensing, data collection and digitized management, of structures and infrastructures for commercial and industrial use located in the port areas under the responsibility of the Eastern Adriatic Sea Port System Authority*" was launched. (**AdSP MAO**)

The object of the tender, in other words, defines as its goal the implementation of a ***digital twinning*** experiment in the context of the port of Trieste, a project in collaboration with AdSP MAO through which Area Science Park aims to define "demonstrator projects," examples of applied innovation.

In particular, the **Port System Authority of the Eastern Adriatic Sea** (AdSP MAO), the governing and managing body of port infrastructure and activities in the areas of Trieste and Monfalcone, has defined the general objectives on which to focus the pilot project, identifying its object in **Warehouse No. 71** of the New Free Point in Trieste.

The Warehouse n.71 in the context of the port of Trieste

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Project

The Warehouses nr. 69 - 71 (Historical Archives Port Authority of the Eastern Adriatic Sea)

The Warehouse nr. 69 (Historical Archives Port Authority of the Eastern Adriatic Sea

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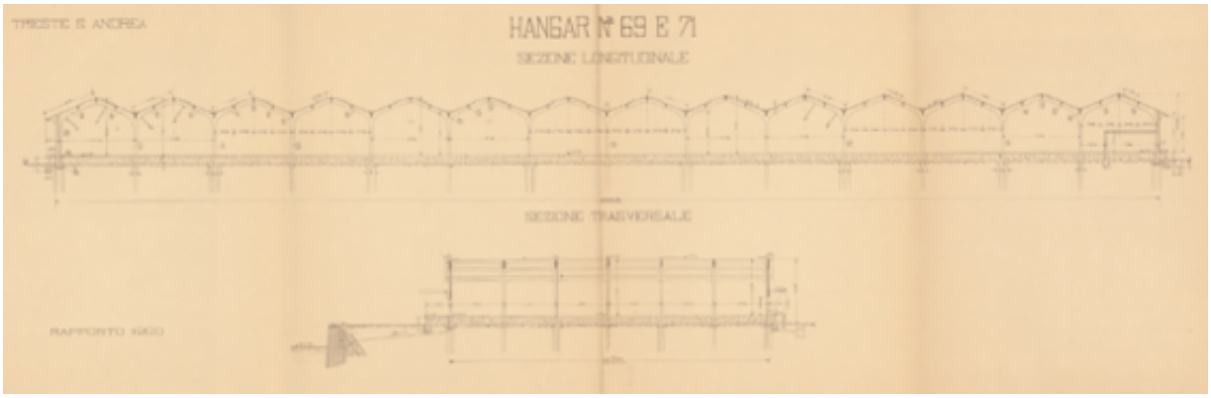
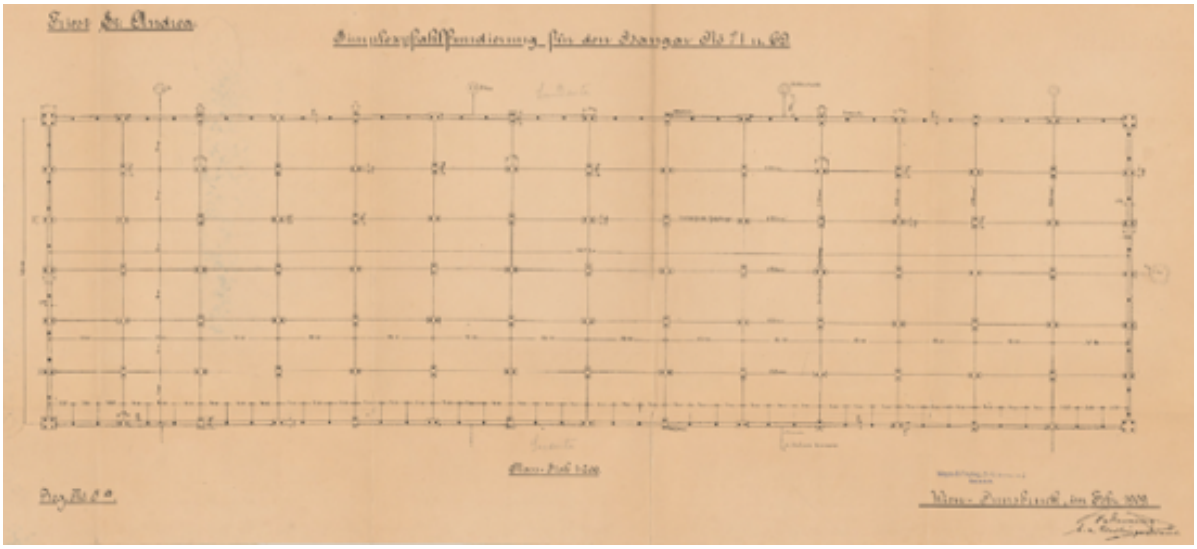
Project



The Warehouses nr.69 - 71, section (Historical Archives Port Authority of the Eastern Adriatic Sea)



The Warehouse n.71, map (Historical Archives Port Authority of the Eastern Adriatic Sea)

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Project

In the Trieste port area, in fact, the AdSP MAO manages a built heritage that occupies a rather large (more than 250,000 sq. m.) and composite area, including buildings, multi-story warehouses, facilities and superstructures (such as access gates to port areas).

The composition of the partnership allowed the project to be already on paper a reference for the geometry of the actors involved, with different needs and activities to manage. In addition to Area Science Park and the Port System Authority of the Eastern Adriatic Sea (AdSP MAO), the project has in fact seen the collaborative participation of a pool of actors, primarily from the port ecosystem, such as: the company **Porto di Trieste Servizi Srl** (PTS), in house of the Port System Authority in charge of maintenance activities on the assets under management of the Authority and of common services to port users; the logistics company **Pacorini Silocaf Srl**, which has the concession of the Warehouse no. 71 for carrying out the shipping, handling, storage and warehousing operations of green coffee.

In carrying out its institutional tasks, the **Authority** is joined by various public actors who, for this purpose, use space and infrastructure made available by AdSP MAO. It is evident how such an ecosystem, where the activities, roles and needs of multiple actors are intertwined, entails different profiles of complexity in the management and control of the port territory. Therefore, the prospect is to make increasing use (including through PTS) of innovative and digital systems for managing three-dimensional models in an integrated *facility management* perspective, capable of visualizing the digital replication of the different components of the asset in a differentiated manner according to roles and interacting with them through the identification of *"what if"* scenarios to ensure effectiveness and efficiency in management and maintenance processes.

The project was launched by a public invitation-only tender. The promoters' choice awarded the bid and offer submitted by **4Days** and **Tre.digital** with partner **Real Comm** because it was the most complete from a technical point of view and also considering the curricula of the project team.

Project team

Truspace | 4Days
Emilio Ziraldo, Marco Lotti, Gabriele Cossu

Tre.digital
Denis Mior

Real Comm
Marco Giacomini

WebRatio
Massimo La Rosa

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Project

From objectives to project phases

The main objective of the project was to create a Digital Twin of a building in the port-identified in Warehouse No. 71, including a laser scanner survey (point cloud) to obtain the starting environment on which to model the 3D model, in its architectural, structural and plant engineering parts.

In the making of the project ,

4Days handled the coordination of the entire project, managing the acquisition of the 3D BIM modeling and the integration of the IoT part with the Truspace platform;

Tre.digital managed the digitization of the asset through a process of point cloud acquisition with laser-scan technology and subsequent 3D BIM modeling;

Real Comm managed the physical part of the IoT sensors, handling the supply, installation and collection of data from the field made available to the Truspace platform.

Therefore, the project consisted of tre following phases:

realization of the disciplinary 3D models, in open BIM IFC standard format, following a scan to bim process executed from point clouds generated by a survey with laser scan techniques and with drone for coverage (**Tre.digital**)

detection of data-performance objective of the project (environmental, energy, structural) through the choice of sensors suitable for the purpose, installed inside the warehouse (**Real Comm**)

adoption of an asset lifecycle management platform with BIM methodology (Truspace) that would act as a system integrator and enable the navigation of models and their information/documents, concurrently with the navigation of IoT data both real time and historical, concurrently with the modeling and management processes of asset maintenance

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"**Denis Mior**, co-founder of **Tre.digital**:
"*We worked both in the field, with surveying through laser scanner technologies, and 'at the desk' to make the digital model. In terms of surveying technologies, we opted to use walk-through laser scanner tools, whereby the person walks within a space and the space is scanned, that is a very interesting technology because it is accurate but fast.*"

The interior survey of the Warehouse nr.71

Instead, for the survey of the exterior areas, we used the drone to be able to take the entire exterior of the warehouse, thus obtaining the so-called "point cloud".

Survey of exterior parts of the Warehouse nr.71 (point cloud)

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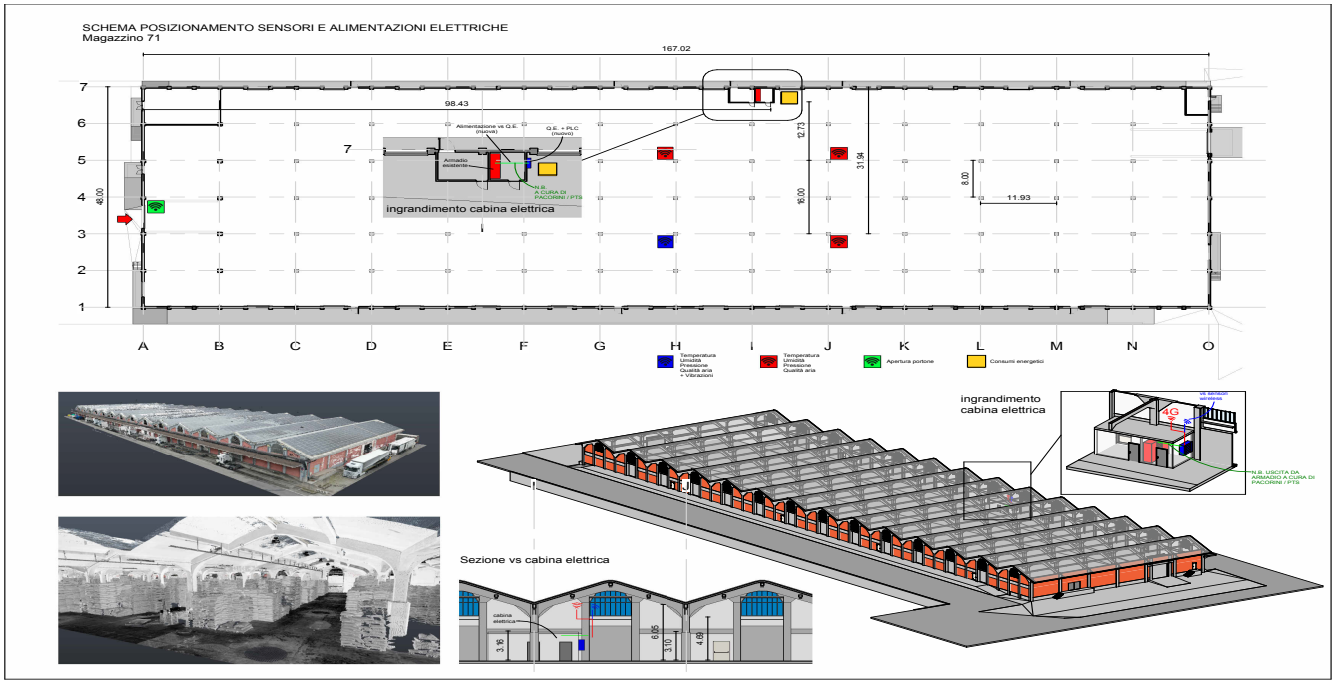
Project

From the point cloud and the plant survey, we defined the digital model-the BIM model-which was structured and coded to be effective from the point of view of data input for maintenance purposes.

Then, we codified what would be the subject of maintenance, giving it a surname name and accompanying it with a series of information with the aim of creating the first database on which then, through the platform, to intervene in the management processes of operation. That is, we initiated together with 4Days what is called geometric modeling and information modeling of the asset.

*We followed the coordination of the IoT part with **4Days** and **Real Comm** for the activities in related to the installation of the sensors in the warehouse."*



Sensor positioning in the Warehouse nr.71

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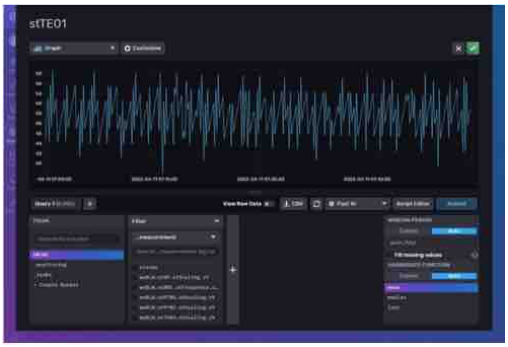
Project

Marco Giacomini, *engineer of* ***Real Comm***

"In the Port of Trieste project, we intervened by managing the sensor part, implementing a HyperFIELD solution, an innovative IOT service that exposes the MQTT protocol natively, according to the following macroactivities:

- *the preliminary on-site analysis on what we would need to interconnect (machinery/plants/devices);*
- *the development of possible connectors to MQTT, in other words, sensor integration;*
- *the identification of sensor hardware, that is a complex task because identifying the right sensors with characteristics, desired performance/price ratio, and required reliability, is not trivial, taking into account that sensors are perpetually changing;*
- *the design of high-reliability architecture, a distinctive aspect compared to other IoT projects. To ensure reliability, i.e., to ensure that data is accessible even in the event of a network failure, an architecture was developed that provides storage in the field (a database) and replication on the data center. In this way, even in the absence of a network, data acquisition continues until the connection resumes, eliminating any loss of data. This is a great mechanism not found in other IoT solutions;*
- *the installation and configuration of an industrial PC that we provided for data acquisition;*
- *the design of the architecture for decoupling and replication;*
- *the configuration of the sensors;*
- *the configuration of the replication in the Cloud;*
- *the VPN installation for the replication in the Cloud;*
- *the development of any additional software modules;*
- *the deployment of the sensing by also making changes to what was originally planned to add more value;*
- *the installation and configuration of required modules in addition to post start-up support*



Integrated diagrams of HyperFIELD

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Project

***Emilio Ziraldo**- co-founder of 4Days*

“The project, which formally began in late October 2022, was completed in late April 2023, lasting about four months. Imagining that during that period many activities were coordinating or contingent on the availability of various stakeholders, this gives an idea of how the process of "digitizing" and returning an existing asset to management is increasingly rapid and concrete.

*In these projects, it is crucial to build a good integration of teams based on different skills, which happened thanks to the excellent contribution of **Tre.digital**, **Real Comm** and **Committenza**, a clear sharing of the project objectives and a clear basic information architecture, detailed both at the level of data model, integration processes and project implementation phases.*

*From a technical point of view, the inherent ability of the Truspace platform to work with standard BIM methodology, to integrate Design&Build processes with Asset Management processes in a single solution, and to be equipped with an infrastructure devoted to integration with IoT processes, constituted a powerful simplification loop. The expertise in the digital surveying and BIM modeling phases by **Tre.digital**, and in the design and installation of the sensor system for target performance detection by **Real Comm**, did the rest.*

*We quickly agreed on the data model useful for management purposes with **Tre.digital** for the BIM modeling phase, the communication protocols (with basic MQTT standards for the IoT part) and backup logics in the absence of network with **Real Comm**, the maintenance processes with the client, and then modeled and integrated them into the Truspace platform.*

The result was to quickly bring to life a digital twin that is complete in its parts, alive in the continuous acquisition and historicization of data and management of maintenance activities, technically deep in its 3D representation and availability of data and documents about the asset, scalable and implementable in all its contents, consistent with open BIM standards, with full satisfaction of the client and partners."

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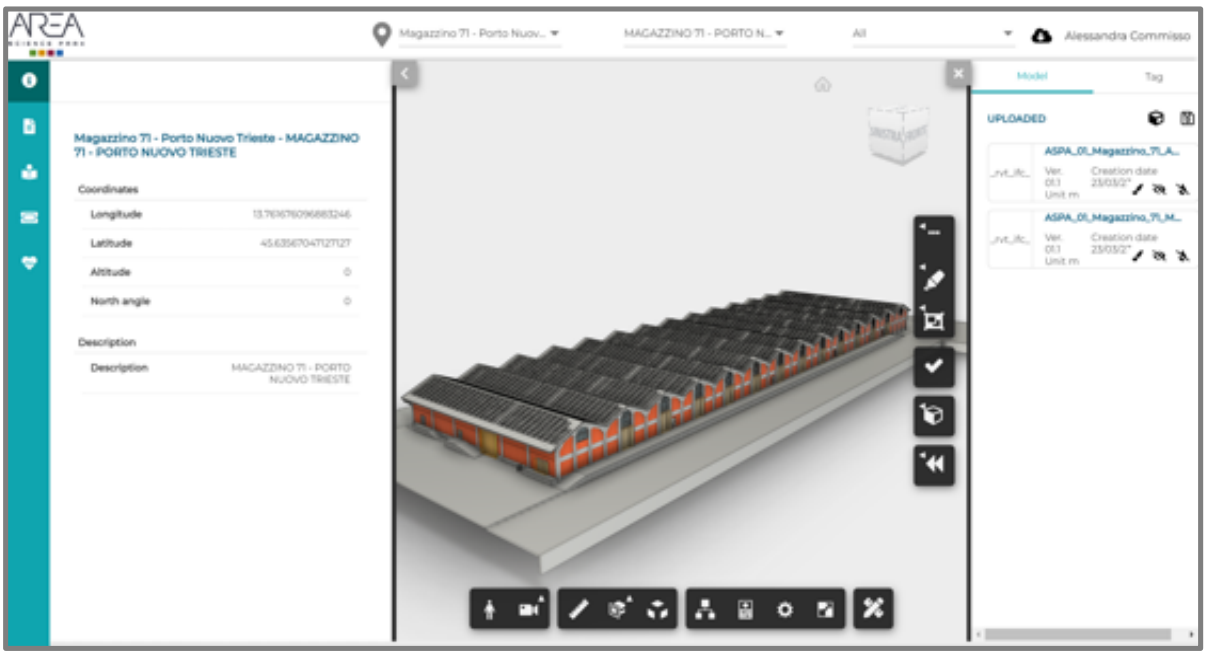
Project

The first results: the “demonstrator” *Digital Twin*

The first goal of the project was successfully achieved and on schedule:
the **Truspace platform** has been built and delivered with the building models and active sensors for data sensing.

The experimental pilot makes explicit and explodes the potential of the solution on building management and maintenance.

The following are some views of the *Digital Twin* of Warehouse nr.71 visualized in the **Truspace platform**. In a highly intuitive way, the digital model can be navigated by operators to verify the data collected from the sensors applied to the building.



Model of the Warehouse nr.71 visualised in the Truspace platform

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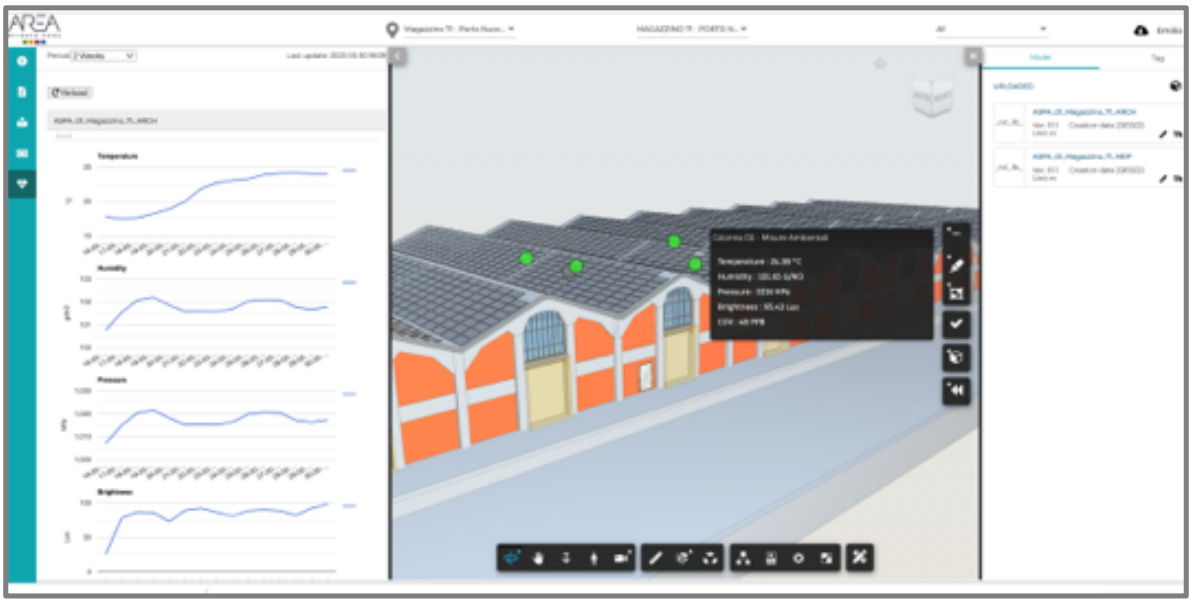
Project

Full view of the architectural and plant model of the Warehouse. 71 with the installed sensors highlighted (in green).



In detail, the measurement trend of the selected sensor. You can see both the detail with mousover on the marker, as well as the detail of the trend graphs by selecting the marker.

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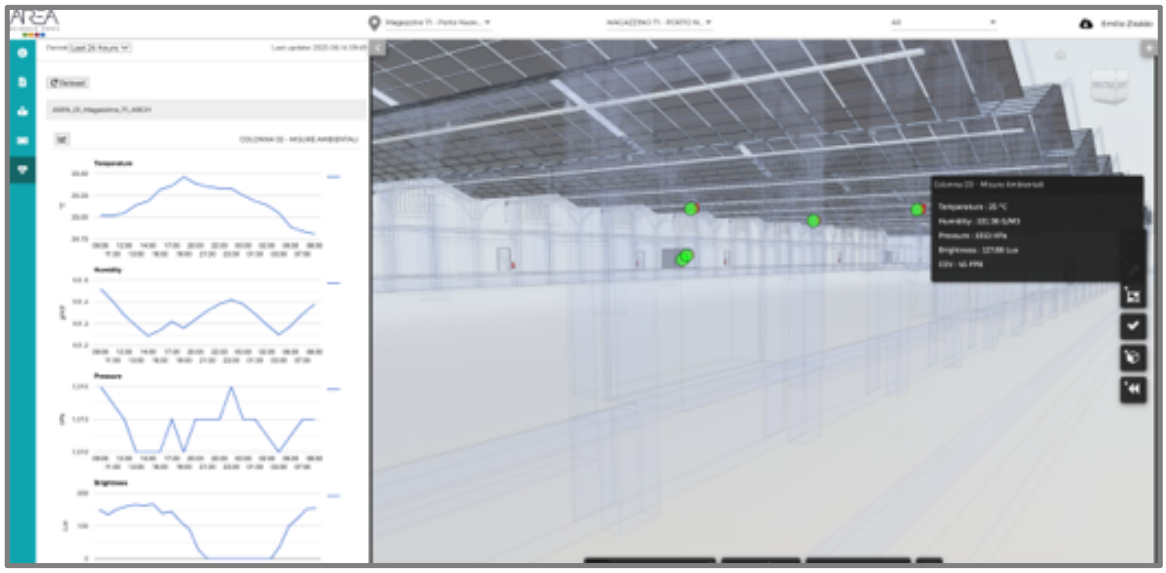
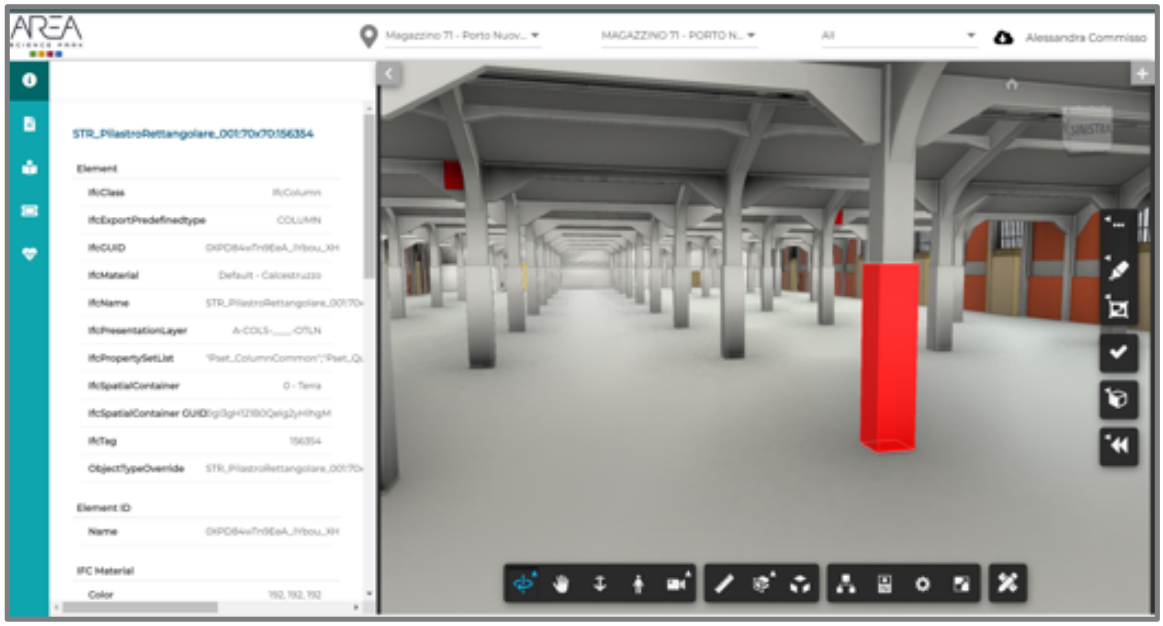
Project



In detail, the the measurement trend of the selected sensor.



The model navigation with the selection of an object

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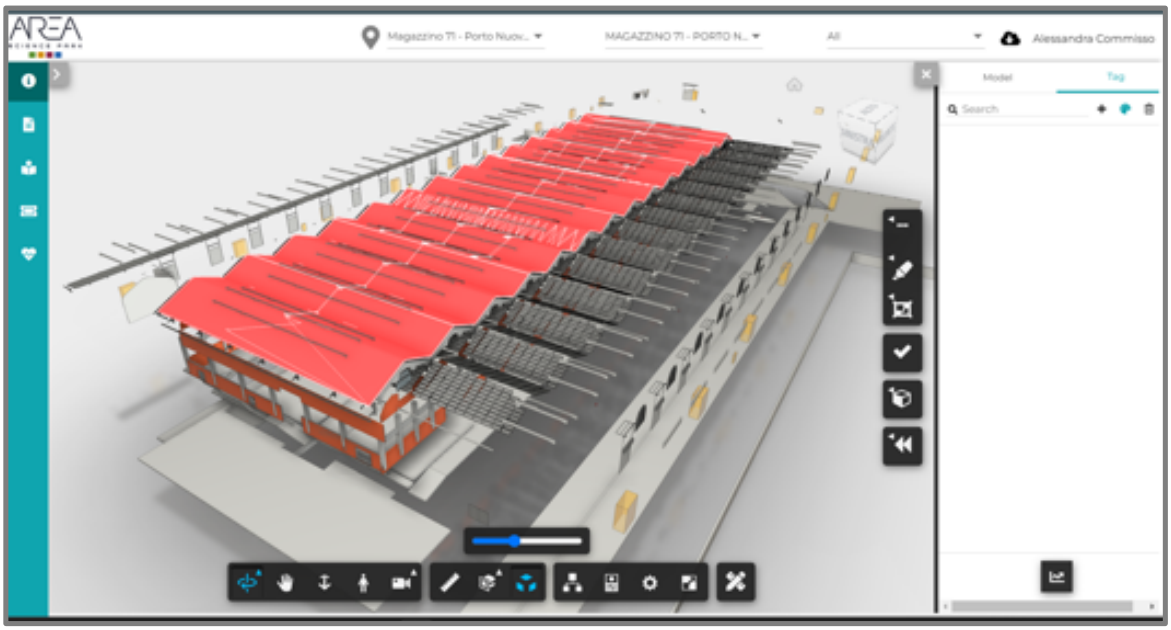
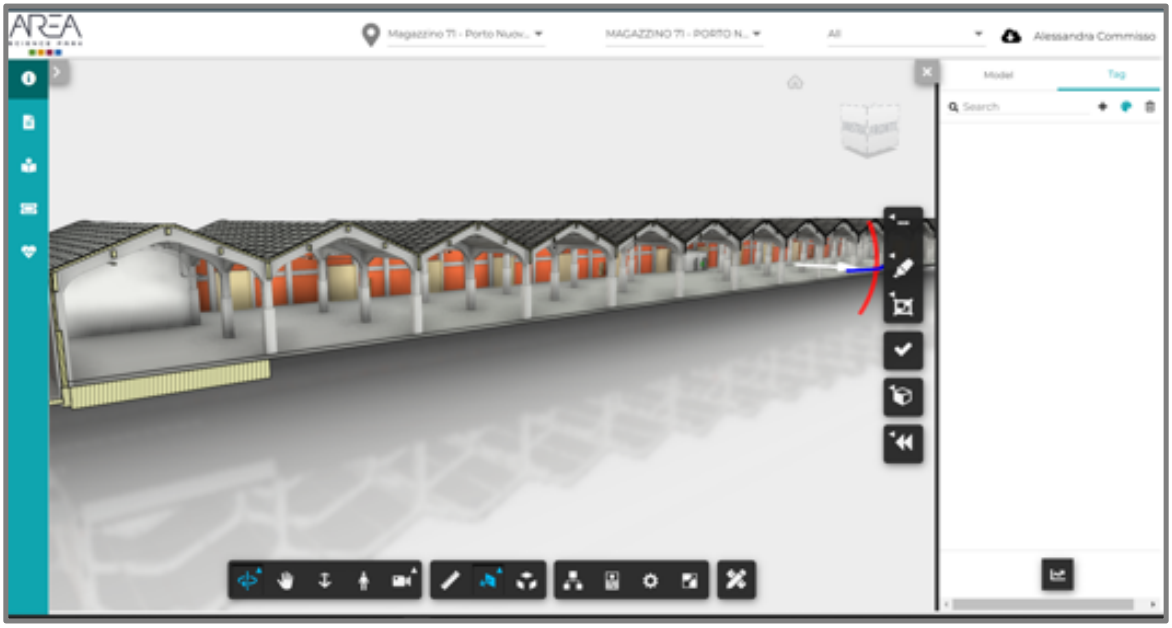
Project



Explosion of the model elements



A section of the model

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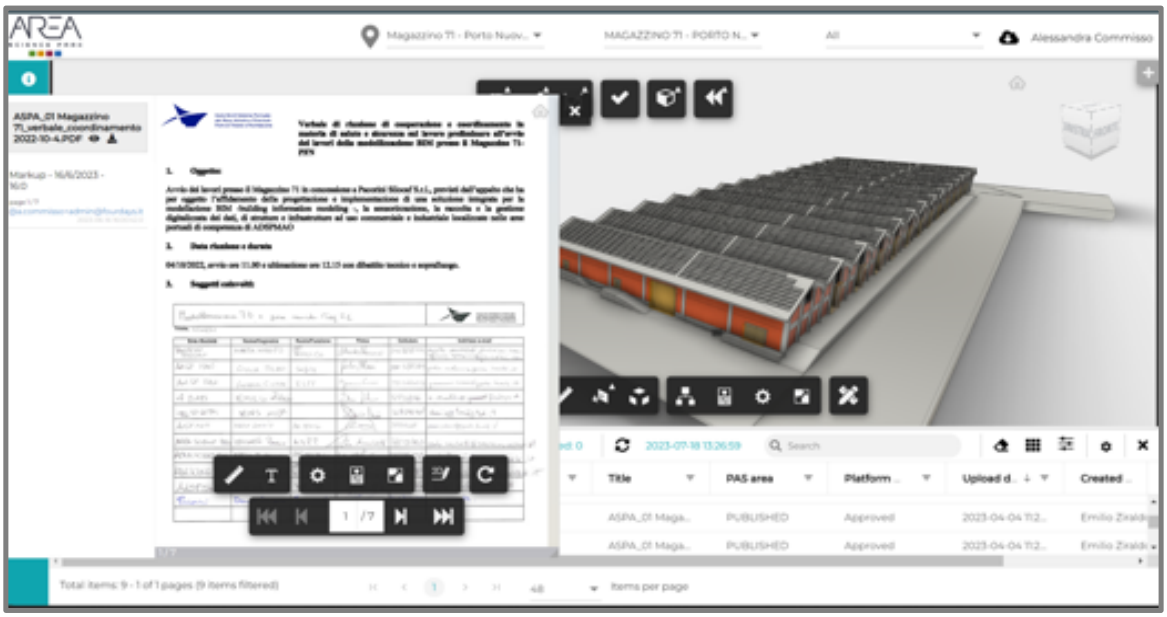
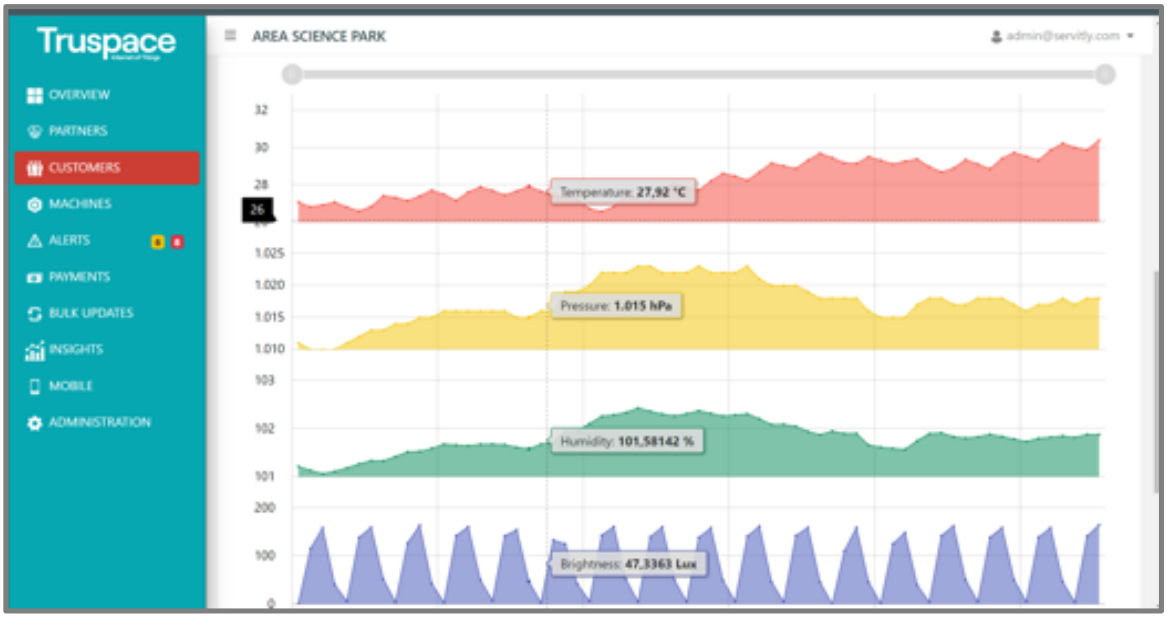
Project



Document management with direct access from the model



Performance synoptic

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Project

Next steps and future prospects

Since this was an experimental activity, the main purpose for the Port of Trieste was to verify cost, time, and potential for imagining its extension on a larger scale.

In other words, to prepare the ground for widespread innovative management at the port as a whole. Therefore, a phase was opened by the Port System Authority dedicated to evaluating the steps necessary to make the use of the model effective within the asset management maintenance processes, analyzing in particular its repercussions on the organizational level, in terms of revisiting the procedures and the interrelationships between the actors involved, as well as identifying the team of people who will actively participate in this path of renewal.

In parallel, the results of the project will be disseminated widely within the port context, to highlight its potential and facilitate its widespread use, also in view of a path to revise the asset organization on BIM processes and digital twin concepts.

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Outcome

The *Digital Twin* was delivered in four months, ahead of the schedule dictated by the client (October- April 2022)

Client and partners collaborated positively to achieve the goal by using highly innovative technologies and solutions to meet the given objectives..

The project enabled the construction of a fully functioning pilot capable of transferring an evolved, highly innovative idea of processes and ways to control and maintain the built environment.

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A single solution to be able to fully manage the asset and its maintenance, easily extensible to the entire port of Trieste.

The solution, integrated with IoT technologies, makes it possible to make concrete logics of sustainability and savings.

Truspace

People

"Area Science Park as part of the initiatives for eco-sustainable industrial development" promoted this intervention on the topic of integrated modeling "smart building & facility management" for the port and logistics areas of Trieste with the aim of raising awareness among public operators on the advanced use of new digital technologies for integrated asset management. Specifically, it was possible with this pilot action to raise awareness about digital tools for the management and use of three-dimensional geo-spatial data and to provide specialized skills (BIM/Digital Twin/facility management) according to the functions performed within the organization. In addition, the intervention has enabled Area science park to build a demonstrator that will be made available to both public and private entities interested in implementing similar solutions for more effective and efficient scheduling of operations of routine and extraordinary maintenance of physical facilities. A next phase of the intervention may be to define some guidelines and best practices for the construction and replicability of the model in its components through the creation of a case study to be disseminated through the most appropriate channels.

Marcello Guaiana
Area Science Park

“The development vision of the Port System Authority of the Eastern Adriatic Sea attaches great importance to a 360-degree knowledge of the infrastructural and environmental components of the port ecosystem. In this sphere, like others of extreme importance for the strategic development of a port with a strong international and sustainable vocation such as that of Trieste, digital transformation imposes and, at the same time, supports a revisiting of processes and modes of intervention that, thanks to the use and systemization of a huge amount of geo-spatial and three-dimensional data, allow for the integrated and intelligent management of functions (of investigation, inspection, maintenance, monitoring, etc.) that touch the entire life cycle of an infrastructure, from the warehouse to the quay.

Truspace

People

It is in this perspective that the pilot project developed in collaboration with Area Science Park and companies in the sector is placed: an initiative that, through the experimentation of concrete solutions for the collection and management of data based on BIM standards, represents a fundamental step in the path of concrete analysis of the potential of digital twinning tools for the creation of digital replicas of physical objects capable of supporting the manager of complex areas and infrastructures in his choices, through the simulation of different scenarios."

Anna Carobolante
AdSP MAO

" The project promoted by the Area Science Park allows us to highlight some elements that, through innovation, allow us to aim for pragmatic and concrete results, on which we are increasingly called upon to make a contribution. First, that the ongoing evolution in the AECO sector, which has digitization and BIM methodology as its main drivers, is a concrete fact, whose outputs are concretely measurable. Being able to equip oneself in a short time with a technical, purely 3D tool for managing the data and maintenance processes of an asset, completely changes the scenario of deliveries and services that a client can obtain today. The fact that such a construct is then consistent with an international standard and is available on a cloud technology, lets one glimpse unprecedented potential for generating efficiencies and in information sharing. The integration finally of such a solution with IoT technologies allows, never before in the industry, to make concrete logics of sustainability and savings, really talking about asset performance. Of course, this concrete process involves focusing on of some major evolutions in organizations and skills;in particular a deep multidisciplinarity of projects and a marked orientation toward the ability to manage processes and models information even before suitable technologies to decline them.

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People

This is affecting, and will increasingly affect, both the public and private sectors, both in the design and construction phase and in the management and optimization phase."

Emilio Ziraldo
4Days

"In realities like those of the Port of Trieste, it is often difficult to control what you have and what is actually maintained. We are talking about buildings and facilities spanning tens and hundreds of square meters where there is no certainty of control. The potential that digitization offers is enormous: the three-dimensional representation of the asset puts clarity and is easily understood even by engineers because BIM simplifies, first of all. The potential of a digital twin of the entire port with data generated in a continuous flow-thanks to the alignment between digital model and reality-would change the management. These are complex processes, of integration between teams and skills, where balancing cost and output is essential. But as technologies advance, people must adapt, understand and embrace the new ways of working. It is a necessary and inevitable transition that must be managed. At this stage there is great experimentation and our ease. Digitizing the built environment, increasing its value through digital technologies, enabling control through digital management of processes, assets, environments, has always been our mission."

Denis Mior
Tre.digital

"We are system integrators by nature; in fact, we integrate environmental sensors by trade. A project of this type is particularly challenging; there is a need to know the environment that has characteristics of unpredictability toward which it is necessary to find a highly reliable solution. We are satisfied with the results and benefits of the designed solution: it allows data security, reliability and scalability.

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People

The design was done with extension in mind so the architecture can be the same for neighboring warehouses.

Virtuous features that allow it to move toward scalability. In summary it was an interesting challenge and we completed it in the way we hoped and wanted, which we hope will soon be extended to the whole pare of the port."

Marco Giacomini
Real Comm

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Integrating possibilities