



Digital twin

Tested in:

- Road construction & maintenance - highway near Gran Sasso Nord, Italy
- Building construction - Helsinki Metropolitan Area, Finland

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Digital Twin

State of the art: In the construction domain, a digital model is still restricted to the stage of a static designed BIM model. The more developed application area remains limited to building design and planning work tasks instead of taking advantage of the rich data that is available in construction operations, as the workers performance and safety, environmental aspects, or automated devices.

Ambition: Implement and integrate into a common environment platform the BEEYONDERS BTs in construction work process, in which decision are supported by the BTs. Provide the full situational awareness as expressed in alternative planning through performed construction site status modeling, workers KPIs and environmental impacts.

Beeyonders developments:

- Modular architecture (Database + Interfaces)
- BIM Updating service
- Input & Output services



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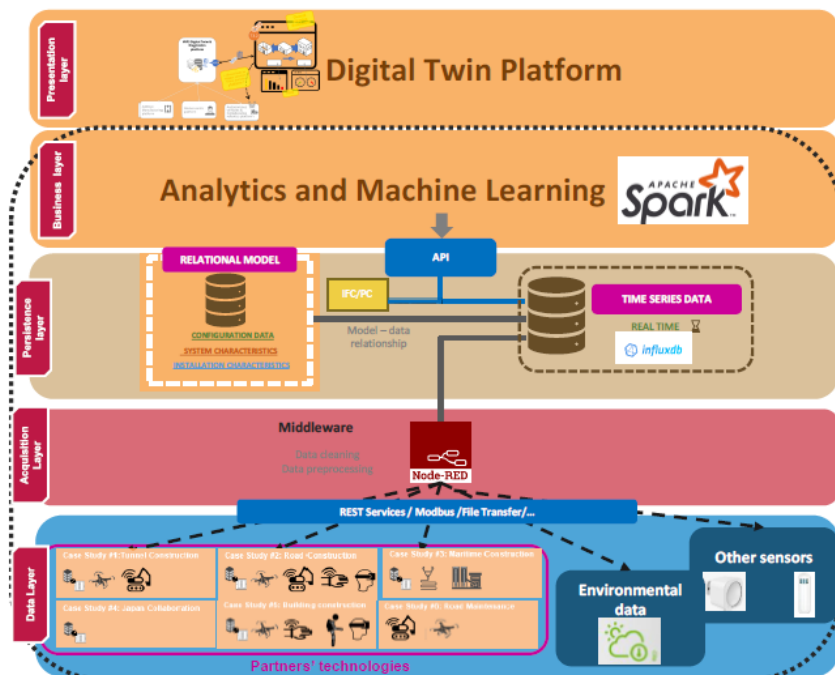


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Modular Architecture & Interfaces

The communication between layers is achieved through APIs (Application Programming Interfaces) that allow different components to interact with each other. The virtual machines communicate with databases to store or retrieve data.



A foundational BEEYONDERS dashboard interface (AngularJS 5 WEB client application) has been created to display BEEYONDERS BTs generated insights.



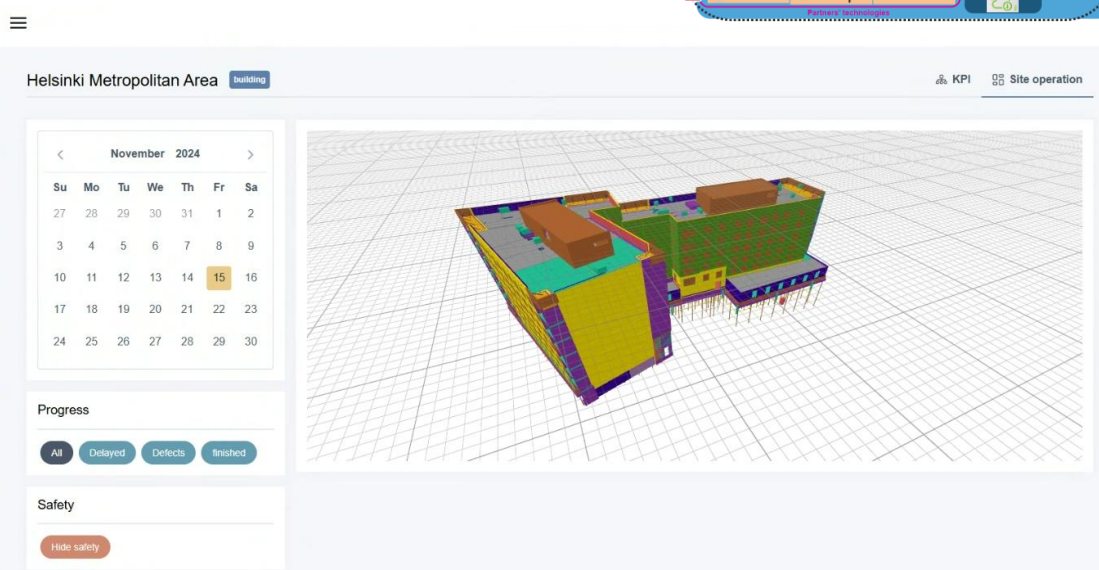
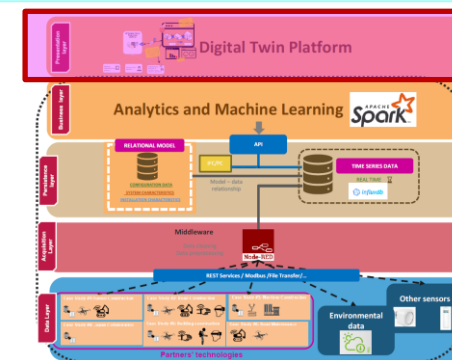
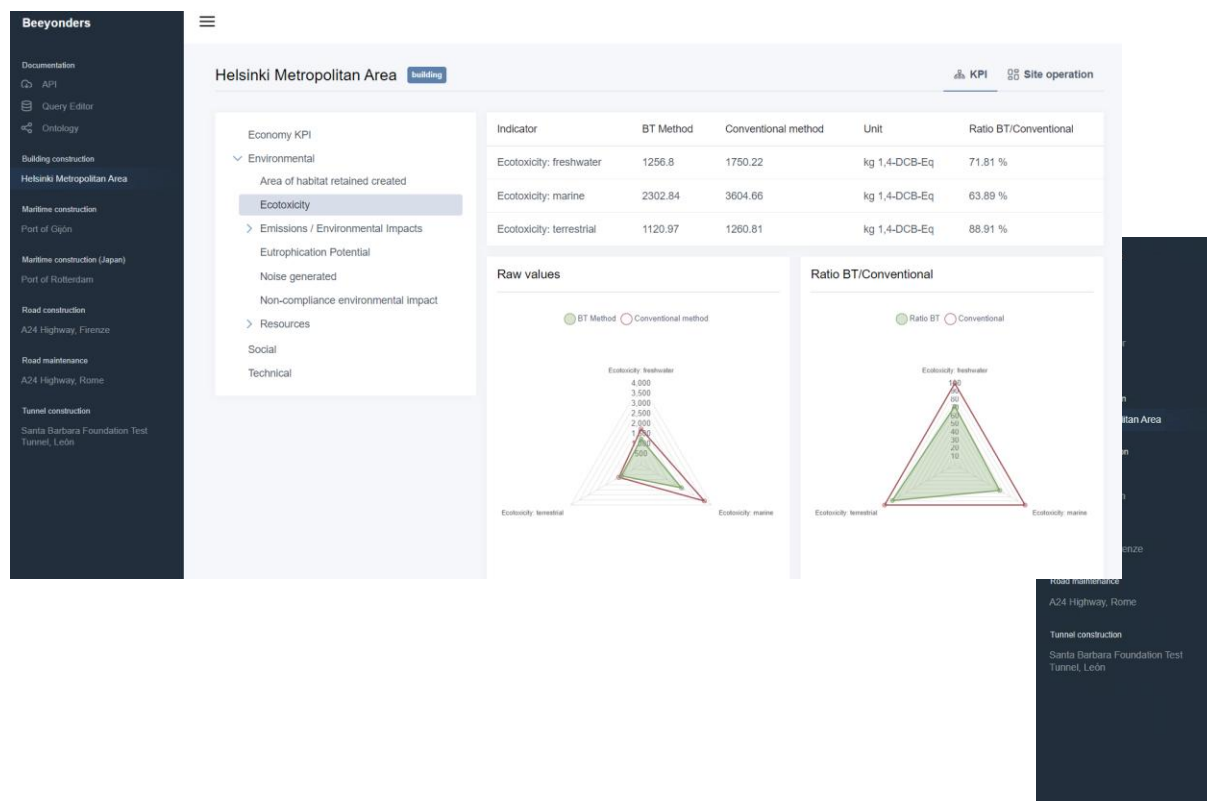
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DT Interfaces: KPIs & Visualization



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BIM Updating service

- Update of the progress of the construction.
- From point cloud by 3D scanning from drones.
- Automated process to identify built elements vs planned.
- BIM model generation to display situation.

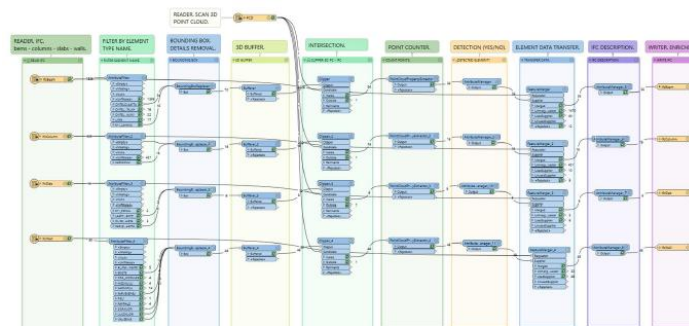
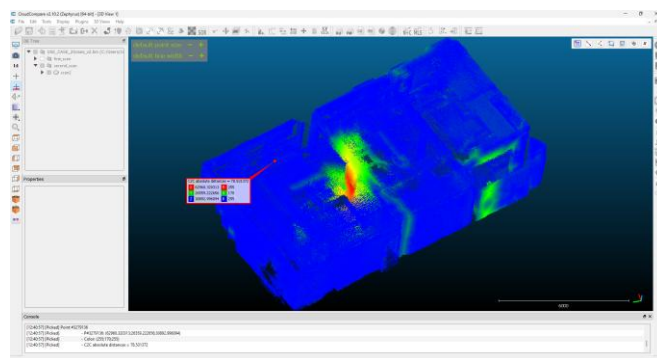
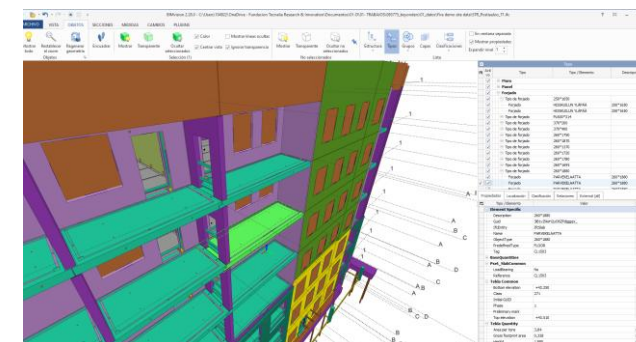
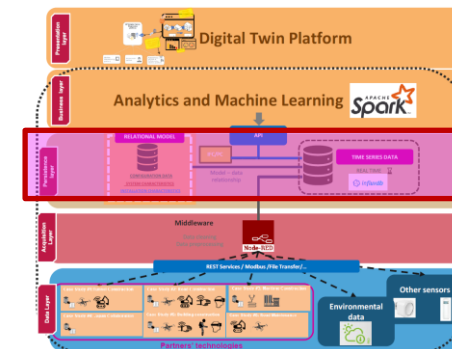


Table View

AttributsKeeper_A_Output - AttributsKeeper_A_Output

Name	ObjectType	Tag	Element	Number of detected points	Detected element (YES/NO)
1. PARVEXPELLE	2702000	Concrete_M-15013	Wall	3950	YES
2. PARVEXPELLE	2702000	Concrete_M-15013	Wall	3710	YES
3. SISAELCURI	2580190	Concrete_SAB-15015	Wall	21604	YES
4. ERISTE	2580190	Insulation_ERISTE-15011	Wall	19410	YES
5. SISAELCURI	2580190	Concrete_SAB-15015	Wall	12421	YES
6. ERISTE	2580190	Insulation_ERISTE-15011	Wall	11225	YES

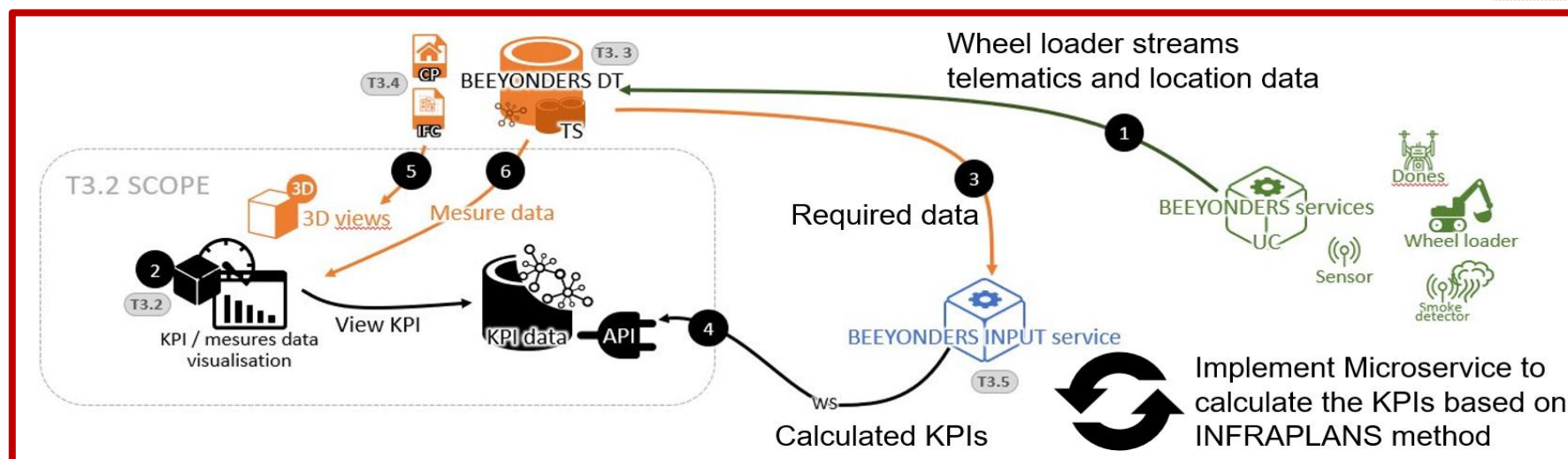
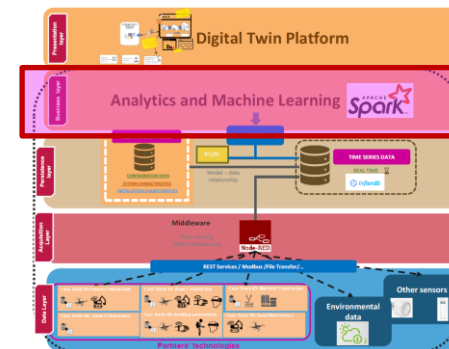


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Digital twin input + output services

- Compute selected KPIs defined based on data from DT
- Address the well-being and safety condition of workers from the prospective of health and ergonomics, planning production control and environmental impacts analysis
- Generate advanced knowledge for decision-makers

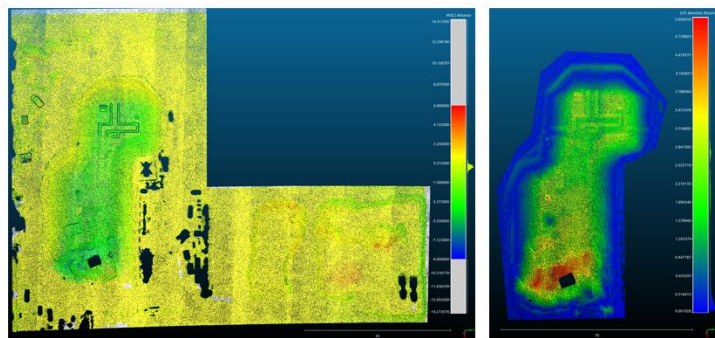




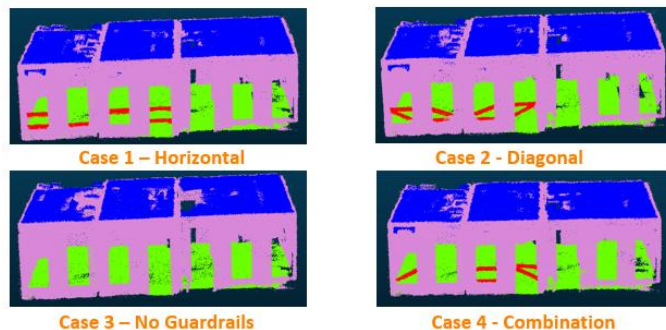
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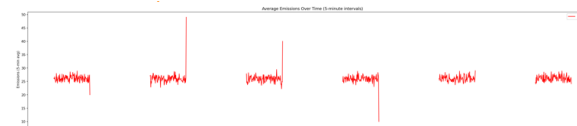
Digital twin input + output services: Applications in Building & Road construction



Progress Monitoring

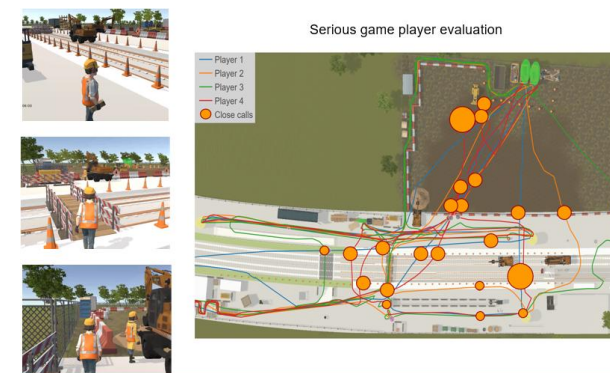


H&S compliance checking



Fuel consumption [t]	Emission factor [g/t of fuel]	Calculated emissions [kg]	Particulate matter formation	Photochemical oxidant formation [Kg NMVOC eq.]	GWP CO2 eq. [kg]
0,085	116	PM	9,86E-03	5,41E-07	n/a
	7663	NOx	6,51E-01	1,04E-06	6,51E-01
	7352	CO	6,25E-01	n/a	2,85E-02
	930	NMVOC	7,91E-02	n/a	7,91E-02
	23	CH4	1,96E-03	n/a	1,97E-05
	3,16E+06	CO2	2,69E+02	n/a	5,83E-02
		Total	1,58E-06	7,59E-01	268,66

Environmental analysis



Training modules



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