



# XXVII FIG CONGRESS

11-15 SEPTEMBER 2022  
Warsaw, Poland

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Proposed 4.0 Industrial Management System for daily operations that poses point cloud assets with annotated real-time sensory measurements and utilizes unsupervised alert logic

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## Study Main Purposes

- The representation of 3D industrial models and 3D industrial infrastructures, using advanced technologies such as Virtual Reality (VR) and web tools,
- The creation of centralized and normalized infrastructure maintenance processes,
- The development of a centralized assets sensory repository with embedded Machine Learning processing capabilities,
- The creation of a unified system that includes Augmented Reality (AR) capabilities in the machinery infrastructure field.



## The Pilot Study Area

Hellenic Petroleum (ELPE) Facilities in Northern Greece

This study took place in three main infrastructures of the central Continuous Catalytic Reforming (CCR) unit of ELPE facilities in Thessaloniki, Greece.



## 3D Laser Scanning Equipment for Digital Twin recreation of the main infrastructure

### Leica RTC360 LT

- Scanning Speed: 1 million points per second
- 3D Point accuracy at 10m: 1.9mm
- Field of view: 360° (horizontal) / 300° (vertical)
- 432 Mpx full dome capture



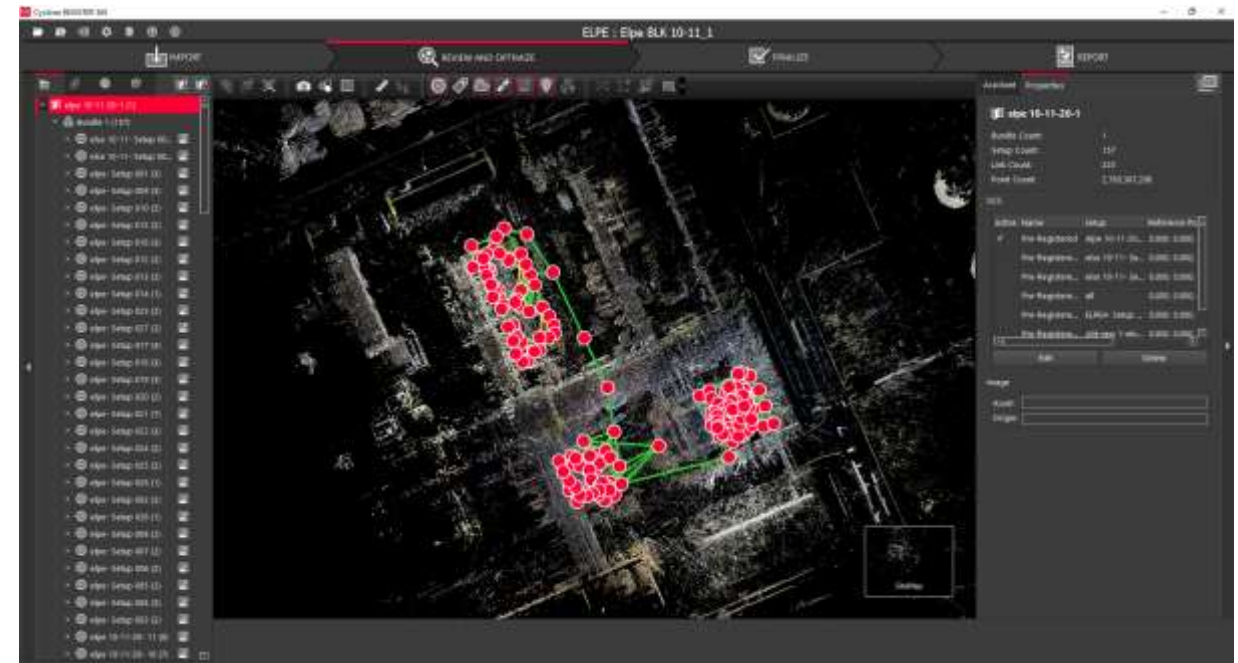
### Leica BLK360

- Scanning Speed: 360,000 points per second
- 3D Point accuracy at 10m: 4mm
- Field of view: 360° (horizontal) / 300° (vertical)
- 150 Mpx full dome capture,
- Infrared sensor for thermal imaging



## Measuring sessions and point cloud post processing

- Total number of 157 traverse (Laser Scanning) points,
- Georeferencing is provided by session scanning proper tags measured with a high precision GNSS receiver (Leica GS15),
- Initial data acquisition and registration on field using Leica Cyclone FIELD 360 iPadOS Application,
- Post process and final registration using Leica Cyclone Register 360 software





## Representation of point cloud using web-based tools and Virtual Reality Headsets



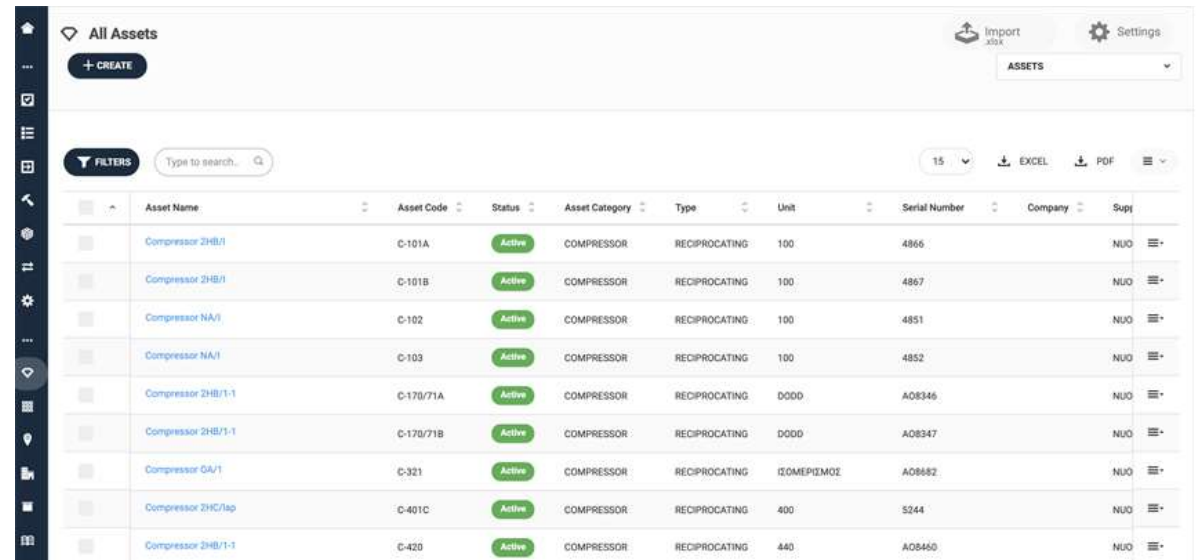
Potree WebGL Point Cloud Open-Source Viewer



Point Cloud visualization using VR headset and FARO SCENE LT software

## Cloud based Maintenance Management System component

- Asset information storage, like name, type, serial number, manufacturer, dimensions,
- Fault prediction using time-series sensory data analysis and visualization for specific metrics



The screenshot displays a web application interface for managing assets. At the top, there is a header with 'All Assets', a '+ CREATE' button, an 'Import .xlsx' button, and a 'Settings' gear icon. Below the header is a search bar labeled 'FILTERS' with the placeholder text 'Type to search...'. To the right of the search bar are options for '15' items per page, and buttons for 'EXCEL', 'PDF', and a menu icon. The main content is a table with the following columns: Asset Name, Asset Code, Status, Asset Category, Type, Unit, Serial Number, Company, and Supp. The table lists several compressor assets, all with a status of 'Active'.

Asset Name	Asset Code	Status	Asset Category	Type	Unit	Serial Number	Company	Supp
Compressor 2HB/I	C-101A	Active	COMPRESSOR	RECIPROCATING	100	4866		NUO
Compressor 2HB/I	C-101B	Active	COMPRESSOR	RECIPROCATING	100	4867		NUO
Compressor NA/I	C-102	Active	COMPRESSOR	RECIPROCATING	100	4851		NUO
Compressor NA/I	C-103	Active	COMPRESSOR	RECIPROCATING	100	4852		NUO
Compressor 2HB/I-1	C-170/71A	Active	COMPRESSOR	RECIPROCATING	D000	A08346		NUO
Compressor 2HB/I-1	C-170/71B	Active	COMPRESSOR	RECIPROCATING	D000	A08347		NUO
Compressor GA/I	C-321	Active	COMPRESSOR	RECIPROCATING	ISOMEPIOMOZ	A08682		NUO
Compressor 2HC/Iap	C-401C	Active	COMPRESSOR	RECIPROCATING	400	5244		NUO
Compressor 2HB/I-1	C-420	Active	COMPRESSOR	RECIPROCATING	440	A08460		NUO



## Sensor Measurements component

- The sensory database interface that connects the sensors Measurements component to the data collection via appropriate JSON API,
- The real-time and historical data representation called Stats Manager, based on Telegraf and Grafana, and raw data navigation and update called CRUD Manager for NoSQL data,
- Intelligent Agent, that traverses' data via the JSON API providing assets predictions based on past sensory data

(1) Crud Manager for the compressor with Tag ID e78cc4ffe87a622



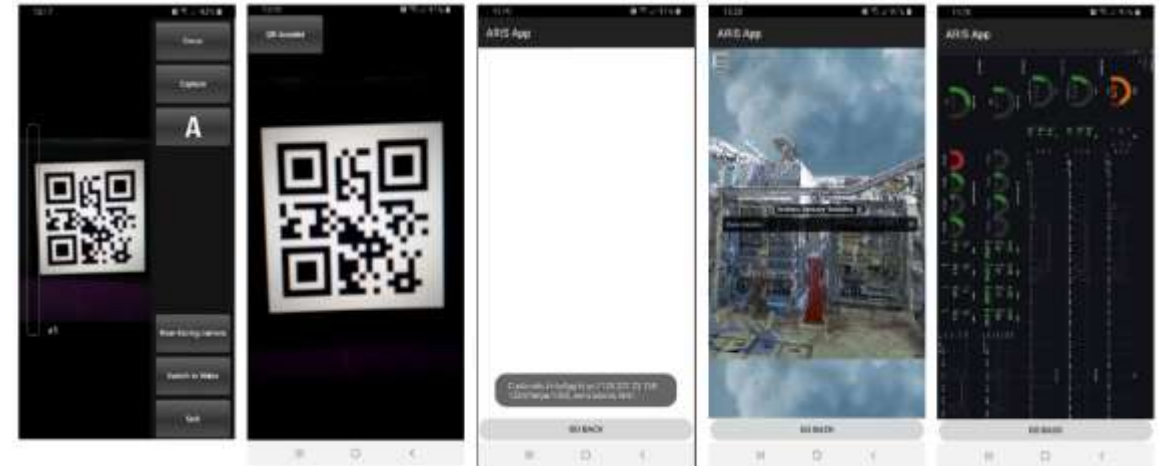
(2) Stats Manager for the compressor with Tag ID e78cc4ffe87a622





## Mobile Application component

- Android based smartphone app allows each user to monitor critical indicators during complex machinery operations,
- The Android based devices that we are using conform to ATEX Zone 1, II 2G; db IIC T4 Gb certification



## Thank you for your attention

### ACKNOWLEDGEMENTS

This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T2EDK-00708).

