



VIII CLGE Conference of the European Surveyor “BLUE SURVEYING”

Innovative technologies with multiple sensor integration to help surveyors in water infrastructure management projects

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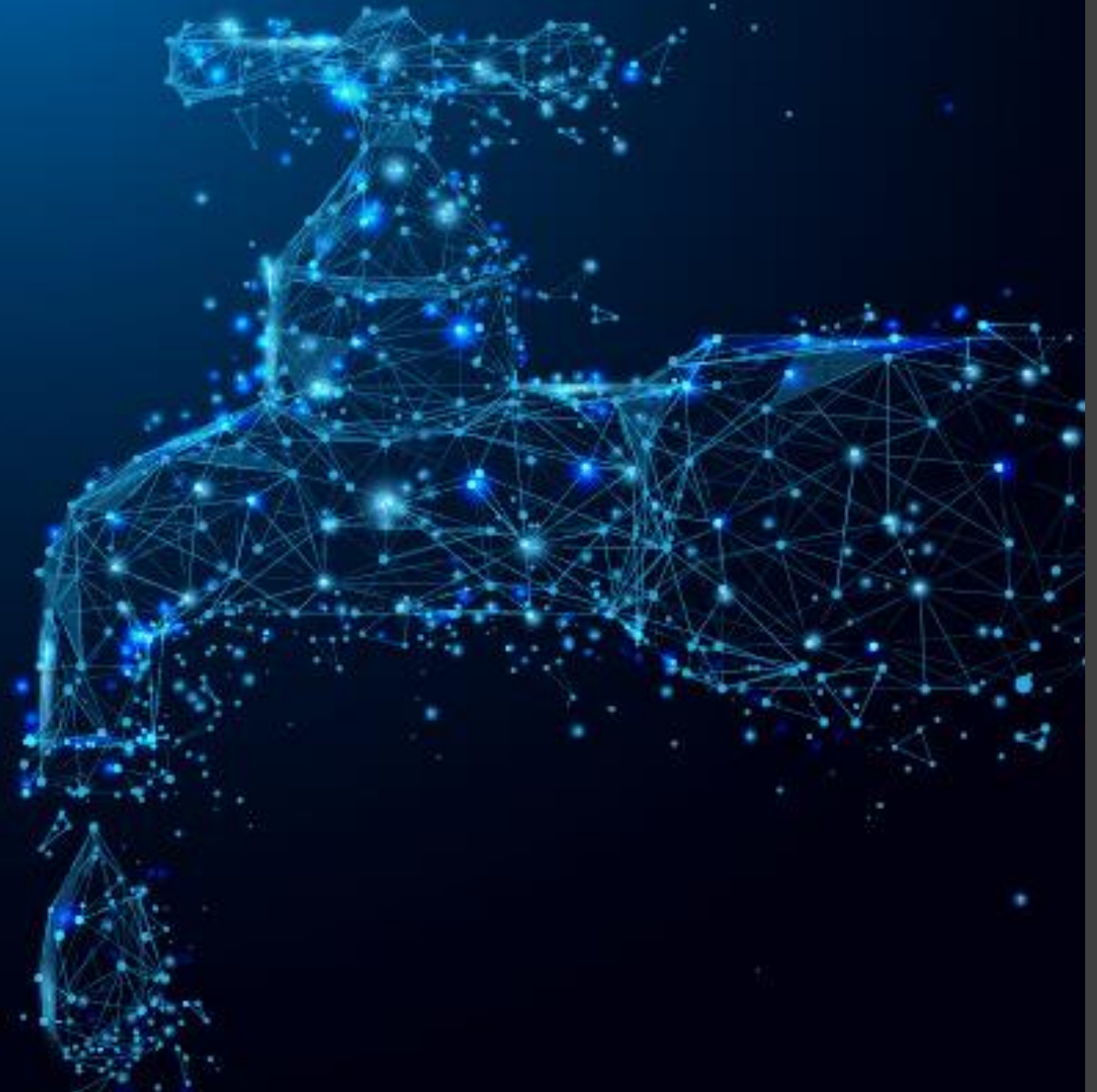
Sevilla (Spain) 27th October 2022 Hotel Barceló Sevilla Renacimiento



Water is a precious commodity, and our duty is to save water, avoid polluting it and wasting it.

Surveyors can contribute, collecting accurate and rich data to maintain and improve water infrastructures.

As much accurate, rich and updated information, better and quicker decisions could be made.





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Lack of maintenance

Bad planification

Old infrastructures

Overpopulation

Over exploitation

No precipitations

Bad residual water management





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A good water management planification needs a lot of different tasks to perform where surveying is needed.

From Reservoirs and Dams maintenance and monitoring to channels and conductions mapping or new water distribution installation and designs





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Some needs in the water management infrastructures where surveyors can help are...

- Dams: monitoring, documentation (as-built)
 - Monitoring of dam walls, movements, status, forces
 - Monitoring of slopes around reservoir and dams
- Channels/rivers
 - Mapping of the bottom of the rivers or channels
- Pipes and distribution infrastructures
 - Documentation, position, status (helps civil engineers to design smarter infrastructures)
- Water treatment plants
 - Design and construction





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Challenge:

- Using nowadays technologies surveyors are performing all these tasks but are efficient? can give more value?

Here, some examples where surveyors are applying new technologies in their daily tasks giving more value to his work.





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Dam and Pipes Monitoring

- from campaign to automatic measurement
- 24/7 systems
- Homogeneous data acquisition (correlation with other sensors)
- Automatic computation and warning systems
- Automatic reports generation
- 3D coordinates, displacements and velocities
- Combination of geodetic, geotechnical, structural and meteo data
- Better understanding of movements and deformations







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Radar: GB-SaR - early warning system

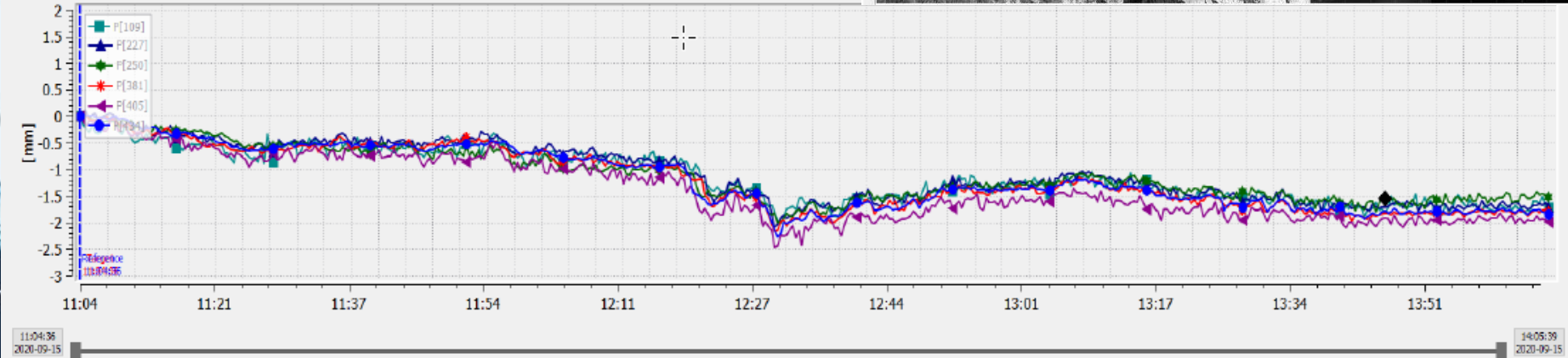
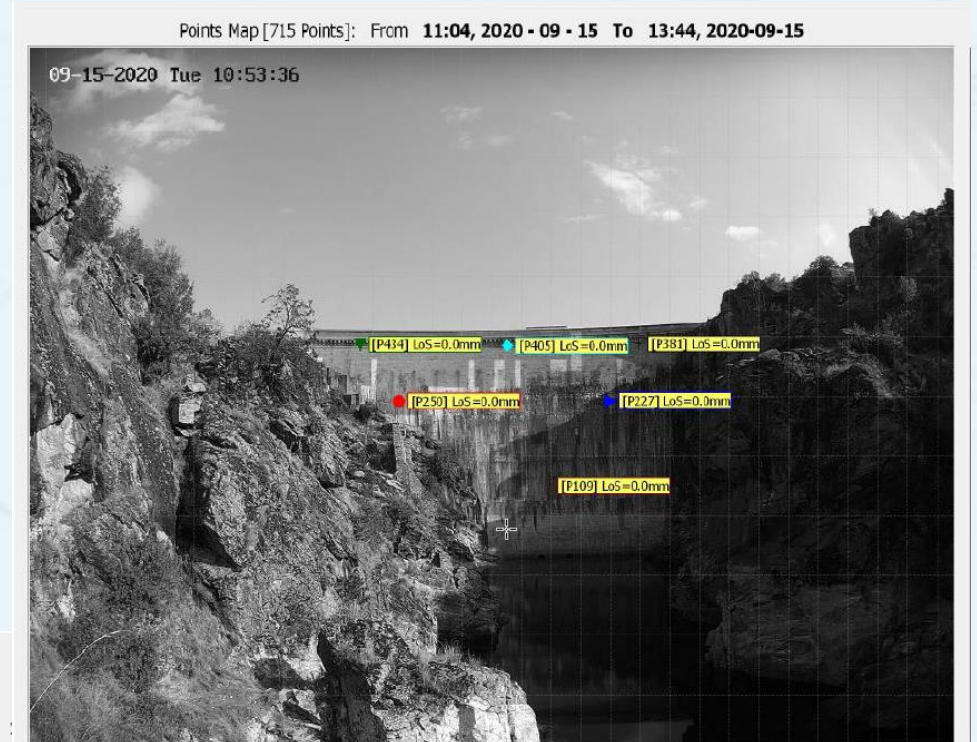
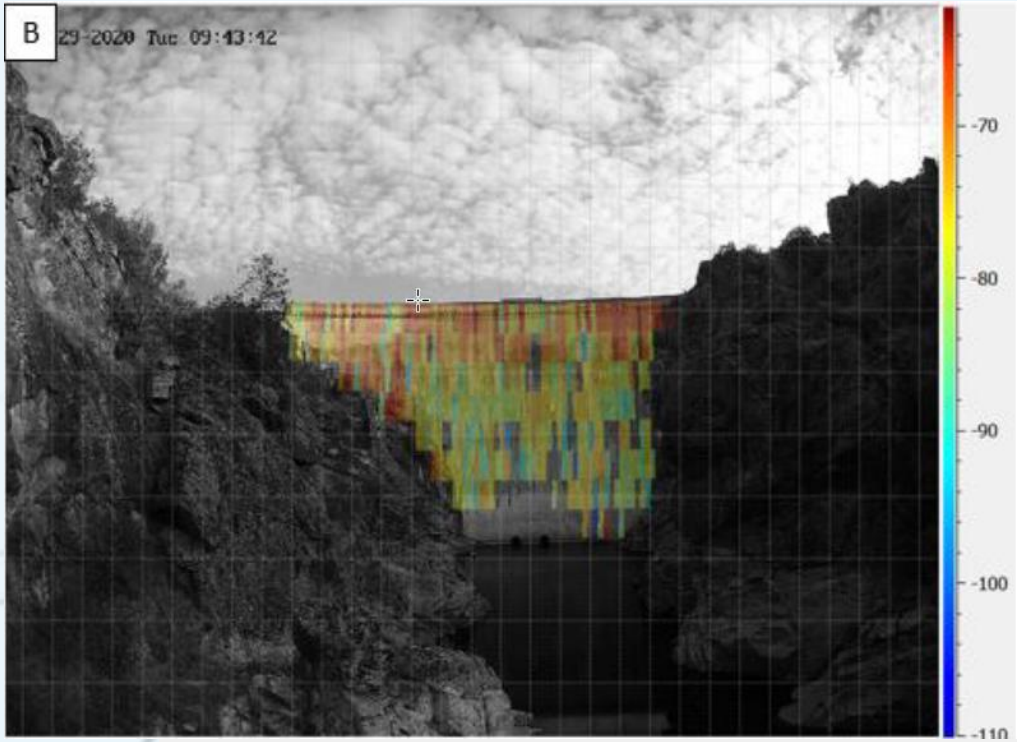
Detection of movements $< 0,1$ mm at 1000 m – Line of sight

Every 30 seconds

Combination with geodetic data for better understanding of movements









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Planification, exploitation and maintenance of water conductions (channels, pipes, residual water treatment plants)

More accurate and rich information helps designers to understand needs in each project

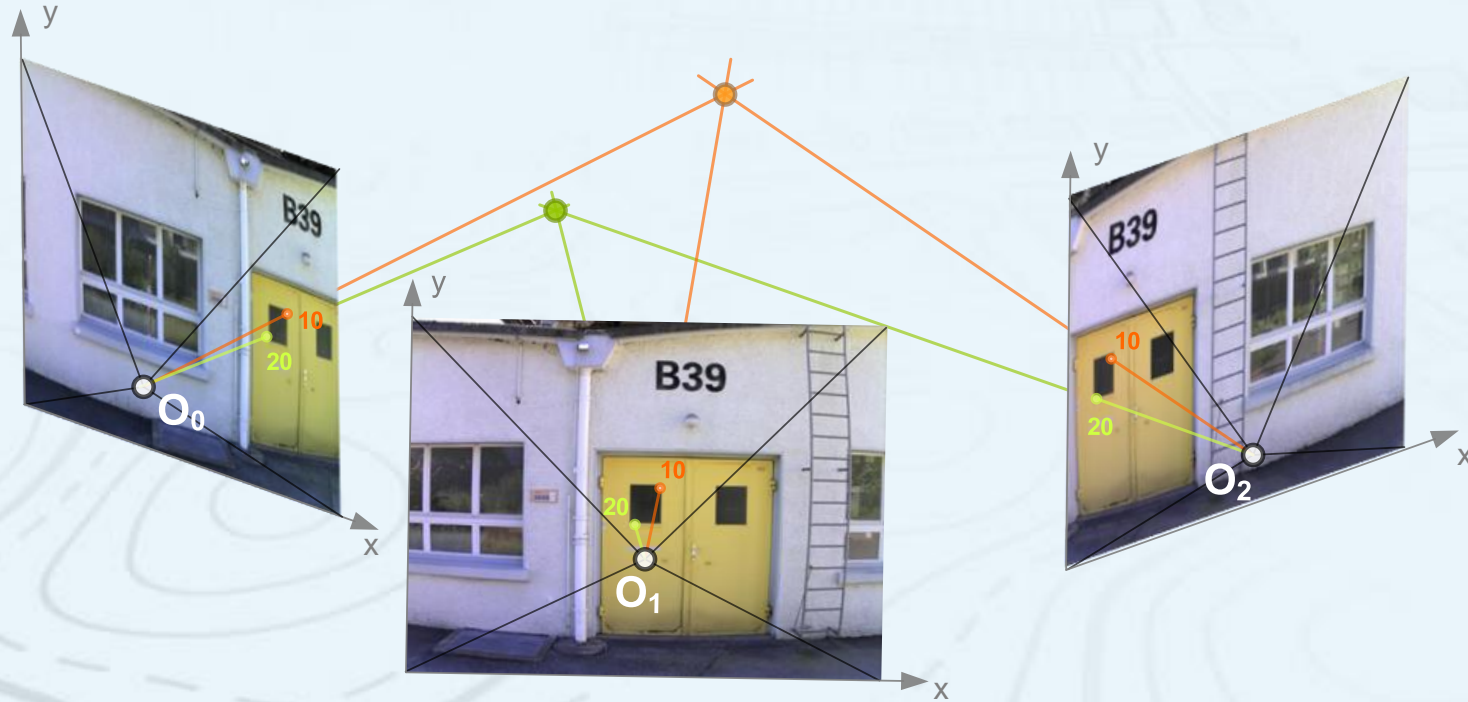
GNSS + Photogrammetric techniques joined together in GNSS systems with Cameras like Leica GS18i

- Not only coordinates
- Not only images to document the project
- Images now are used to measure points (in the present or in the future)
 - This helps to contractors to handle possible nonconformities
 - Measure extra details non measured in the field
- Point clouds from images to have more details
- GIS projects

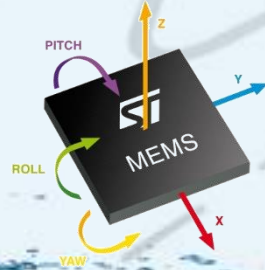




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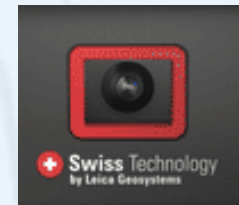
IMU



GNSS



Camera





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VIS (Visual Inertial Systems)

Combine images + gnss + inertial data to compute the position and orientation of images

Gives all data to compute coordinates from images in the field or office.

Combine of images + inertial + scanner data

Position of scans to improve the registration process saving a lot of time.





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...but if we need more precision or we have not good sky visibility? we still need to use a Total Station

Challenges using TS are:

- Risky areas like deep ditches
- Obstructions (needs to change TS position)
- Coordinate Quality
- Productivity

... a system that could be used with the pole tilted could help in all of this survey tasks





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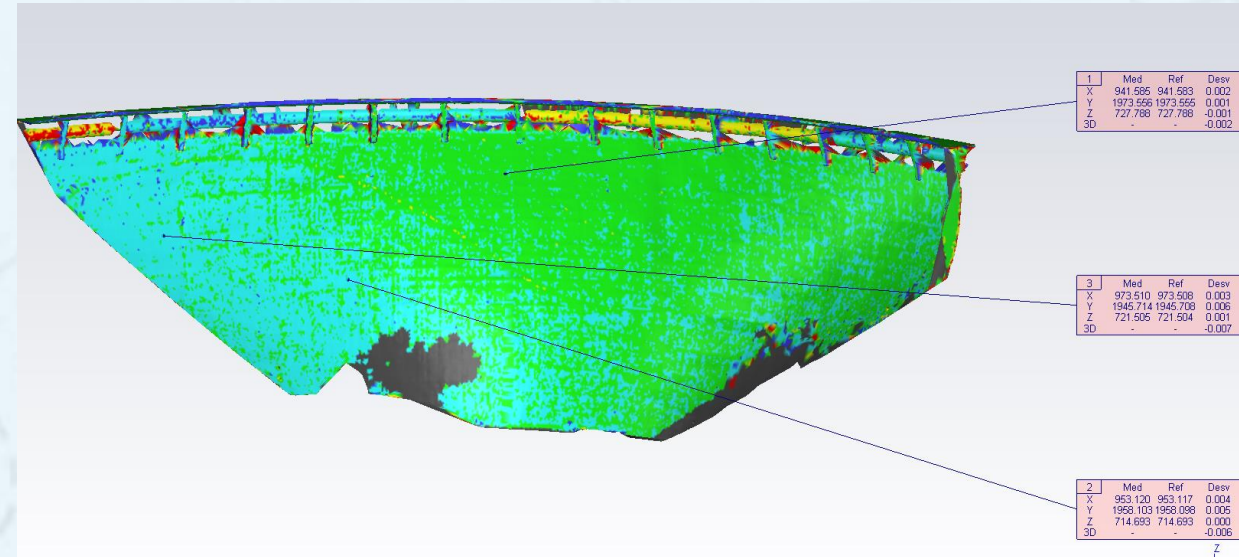
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Digital twins from infrastructures (Dams, Reservoirs, Channels...)

- Documentation and infrastructure monitoring

- **Point clouds / Images and more measured in minutes with Scanner Laser**

- Million points in minutes
- High density / details
- High accuracy





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Digital twins from infrastructures (Dams, Reservoirs, Channels...)

- Documentation and infrastructure monitoring
- Point clouds / Images and more measured in minutes with Scanner Laser
 - Million points in minutes
 - High density / details
 - High accuracy
- **Autonomous scanner (BLK2FLY and BLK2ARC)**
 - Million points in minutes
 - Quick data acquisition
 - Use in dangerous sites







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Summary

Now surveyors can give...

- More information:
 - Coordinates, velocities, images, point clouds, digital twins
- Faster updating rate:
 - Real time information (if it is needed), faster processing time
- Safer measurements:
 - Remote or autonomous measurements
- Lower costs / higher efficiency:
 - Less equipment thanks to the technology integration

