UNIVERSITEIT TWENTE.

ZoARG | ReDUCE

REDUCTION OF DAMAGE TO UTILITIES AND CAREFUL EXCAVATION

Léon olde Scholtenhuis

Programme leader ZoARG | ReDUCE

Assistant Professor

Dept. of Construction Management and Engineering

zoarg
graafschade reductie

ZoARG | ReDUCE www.zoarg.com

Outlook

1. Personal introduction
2. The ZoARG | ReDUCE initiative
3. Selected projects
4. Ambitions

About me …

Léon olde Scholtenhuis

- Assistant professor Inner City Construction Innovation (2015)
- Fac. Engineering Technology | Construction Management & Eng. dept.
- Ph.D. in Construction Coordination and Visualizations (2015)
- MSc. in Construction Management & Engineering (2012 – with distinction)
- BSc. in Civil Engineering (2009)

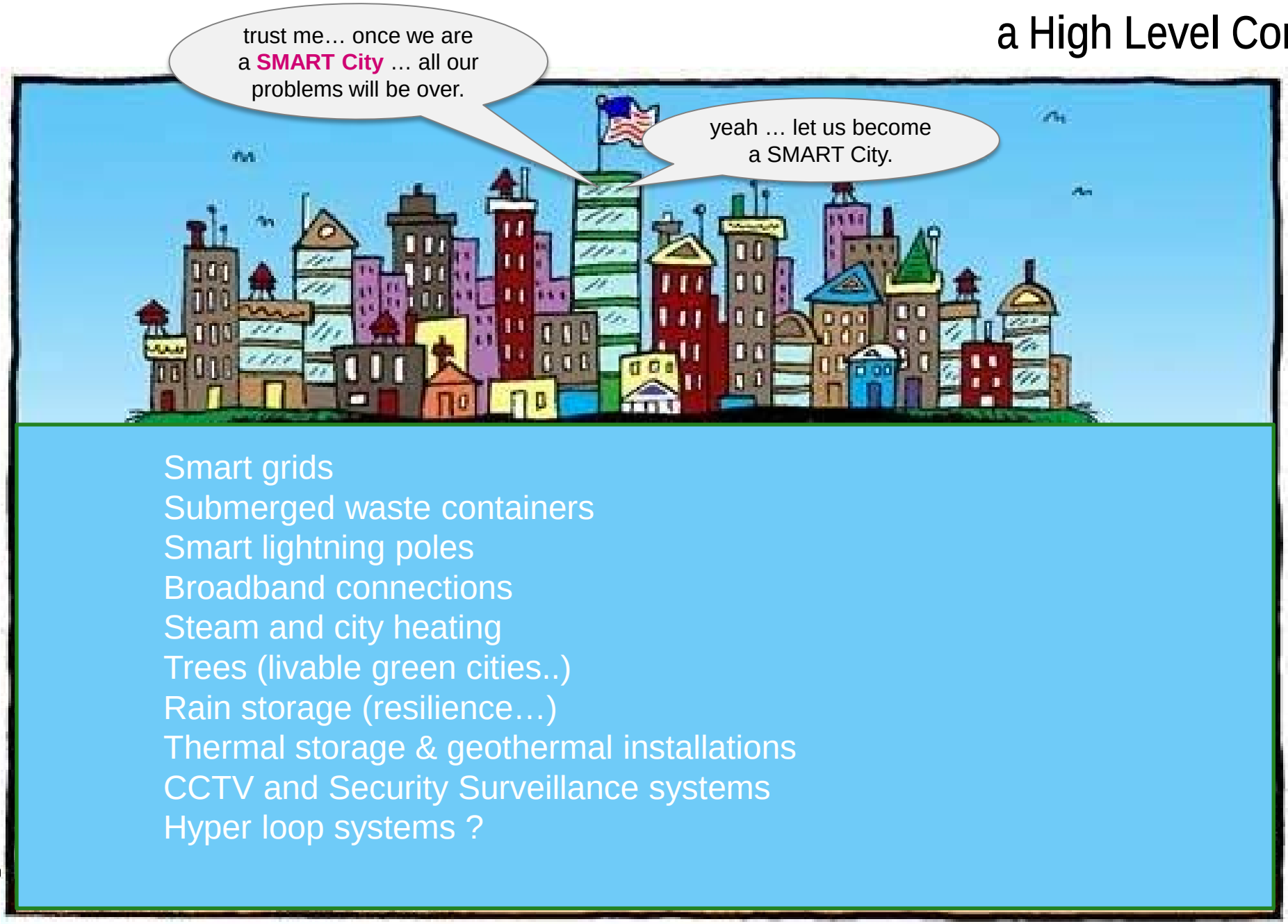
Teach in *civil engineering*

- Building Information Modelling, 5D and Planning (MSc.)
- Markets Organizations and Innovation in Construction (MSc.)
- Smart Ways to get Smart Cities Smarter (BSc.)
- Supervisor of BSc. (~20) & MSc. (~5) thesis, P.D.Eng (3), Ph.D. (1) projects
- Ph.D. seminars on academic writing

Research into *inner city construction*

- Virtual technologies to support subsurface utility projects
- Information and technology for Civil Engineering domain
- Coordination & organization
- Careful excavation
- Key words: ethnography, system design, field research, relevance
- Programme leader of ZoARG | ReDUCE programme (www.zoarg.com)

a High Level Conversation

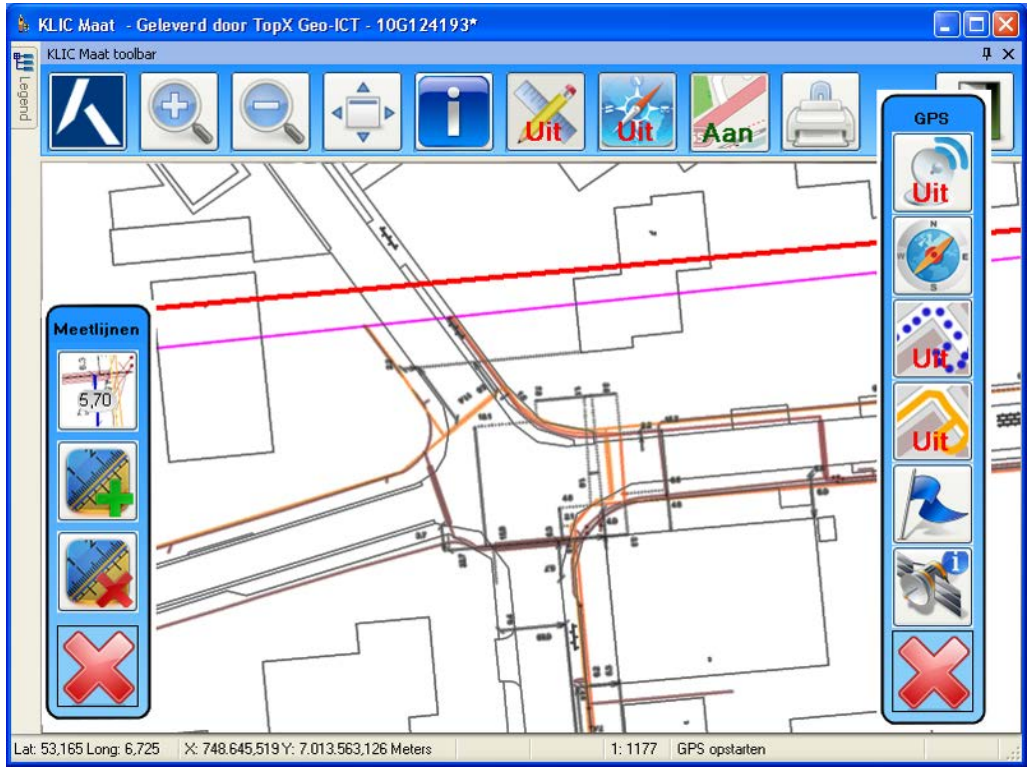


Smart grids
Submerged waste containers
Smart lightning poles
Broadband connections
Steam and city heating
Trees (livable green cities..)
Rain storage (resilience…)
Thermal storage & geothermal installations
CCTV and Security Surveillance systems
Hyper loop systems ?

How we like to see city infrastructure (plans)

How we model our cities' buried infrastructure

DUTCH KLIC-MELDING (UTILITY PLAN: RASTER FILE; 2D; POLYLINES; SCHEMATIC)

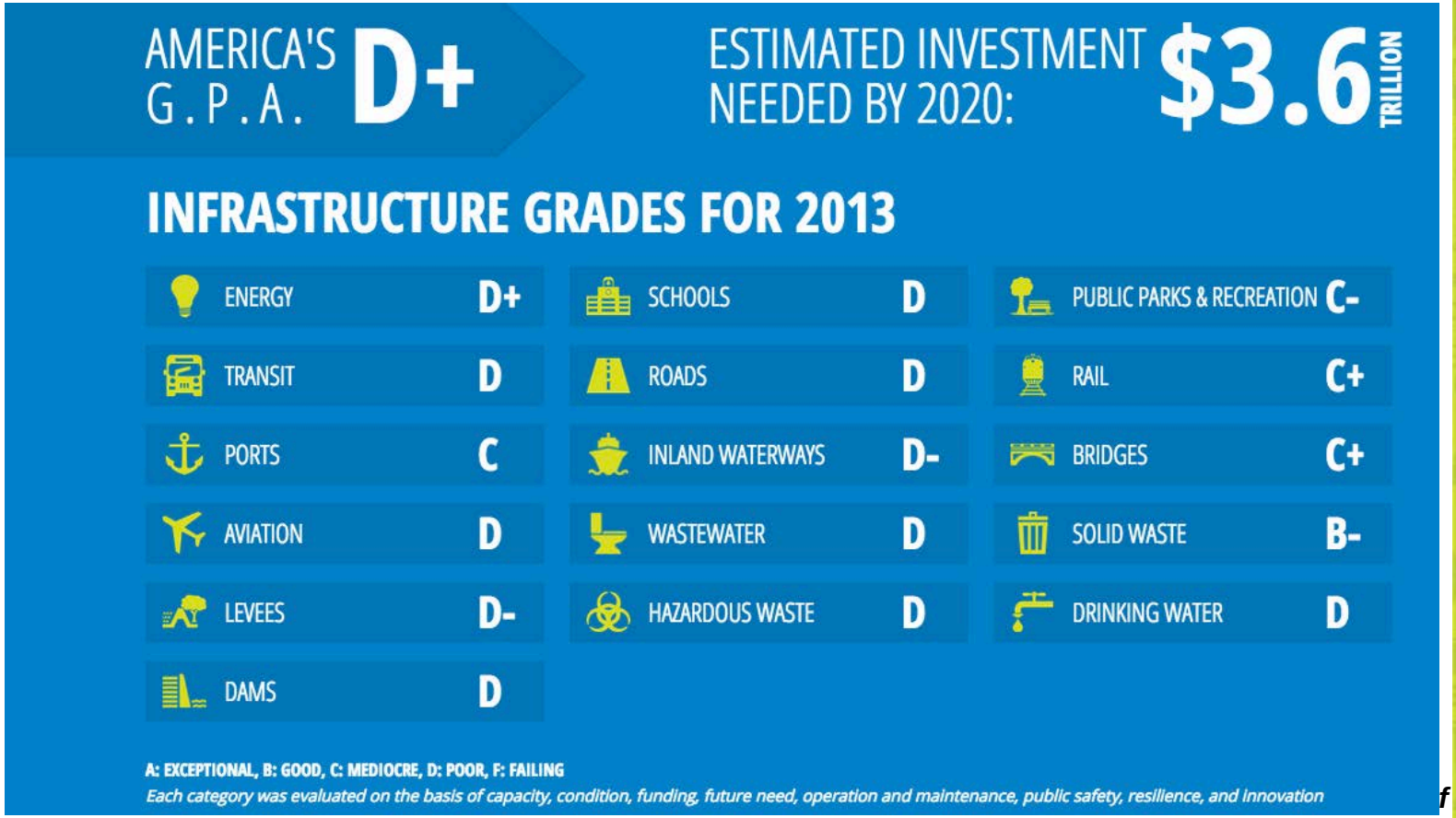


How it looks like … existing cables & pipes ~2 mil km

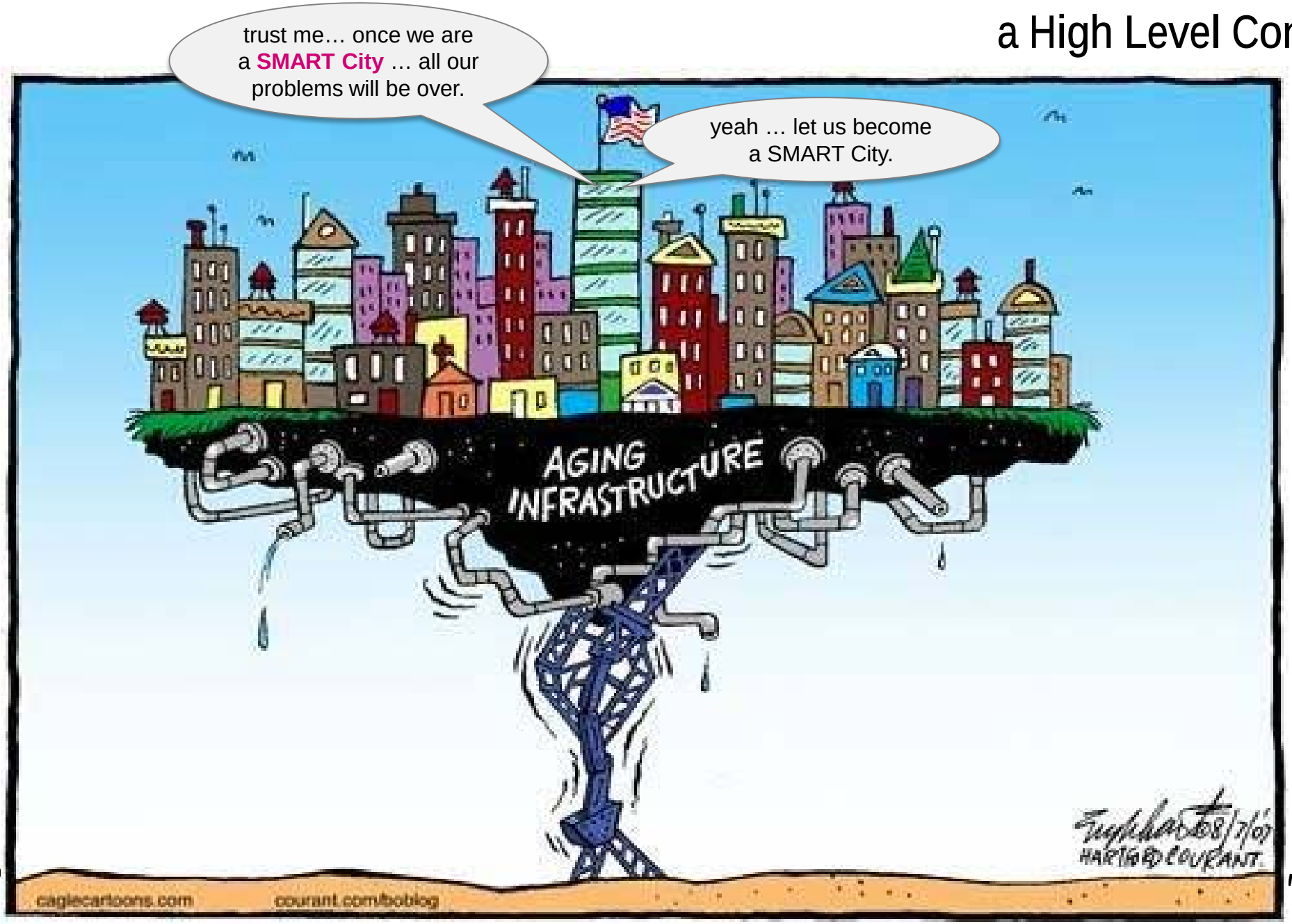
Planning, construction, maintenance issues

Infrastructure Report Card 2017

By the American Society of Civil Engineers (ASCE)



a High Level Conversation



Liberalization of city infrastructure: many owners and contractors involved

COGAS

STEDIN.NET

ENEXIS

alliander

vitens

Ziggo

lijbrandt
Powered by Glashart

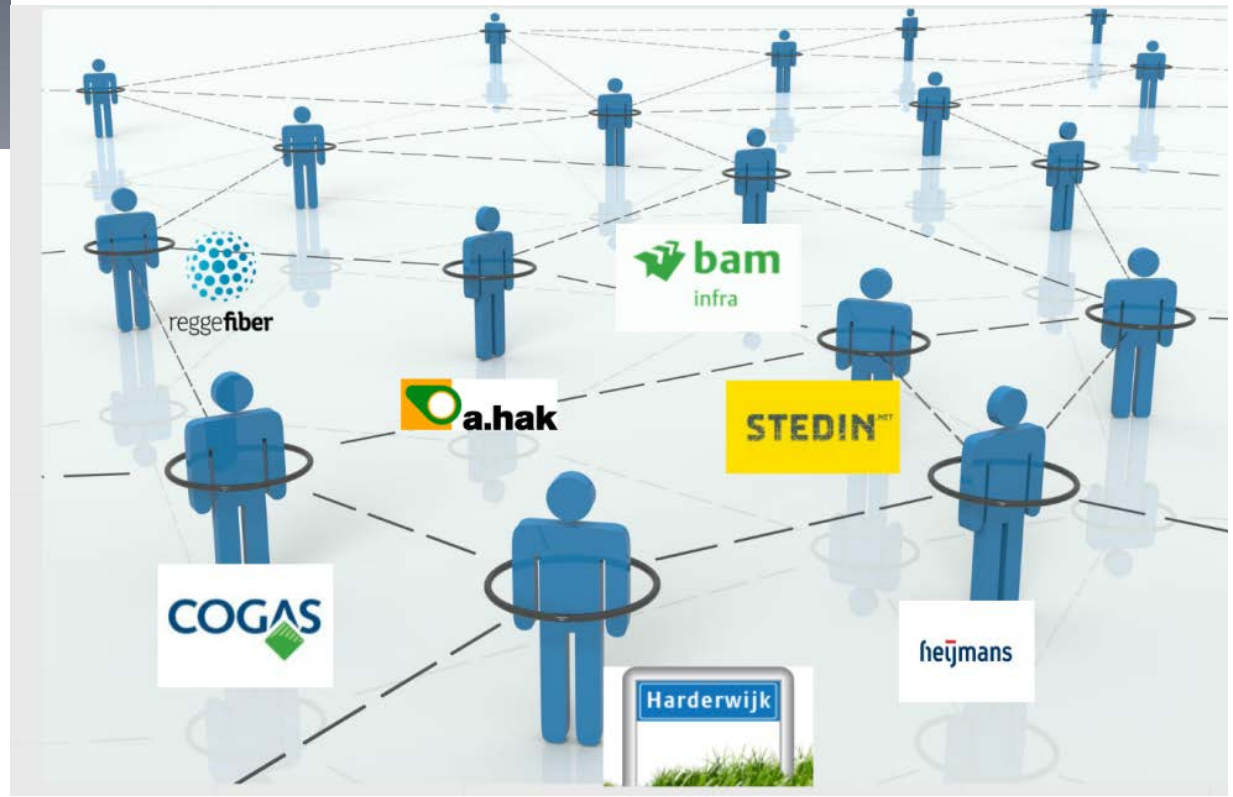
ptt telecom

kpn

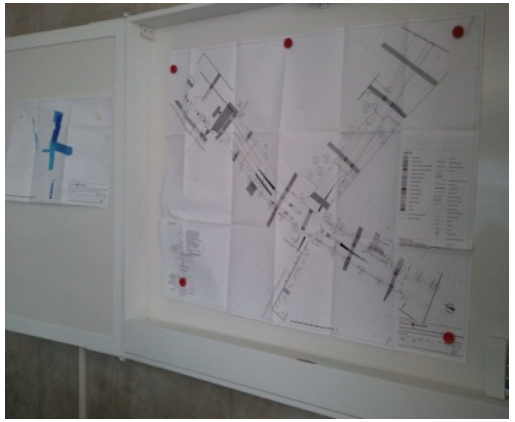
reggefiber

Difficult to manage construction work

Due to organizational fragmentation, and diffused data



Paper-based, ill-structured practice







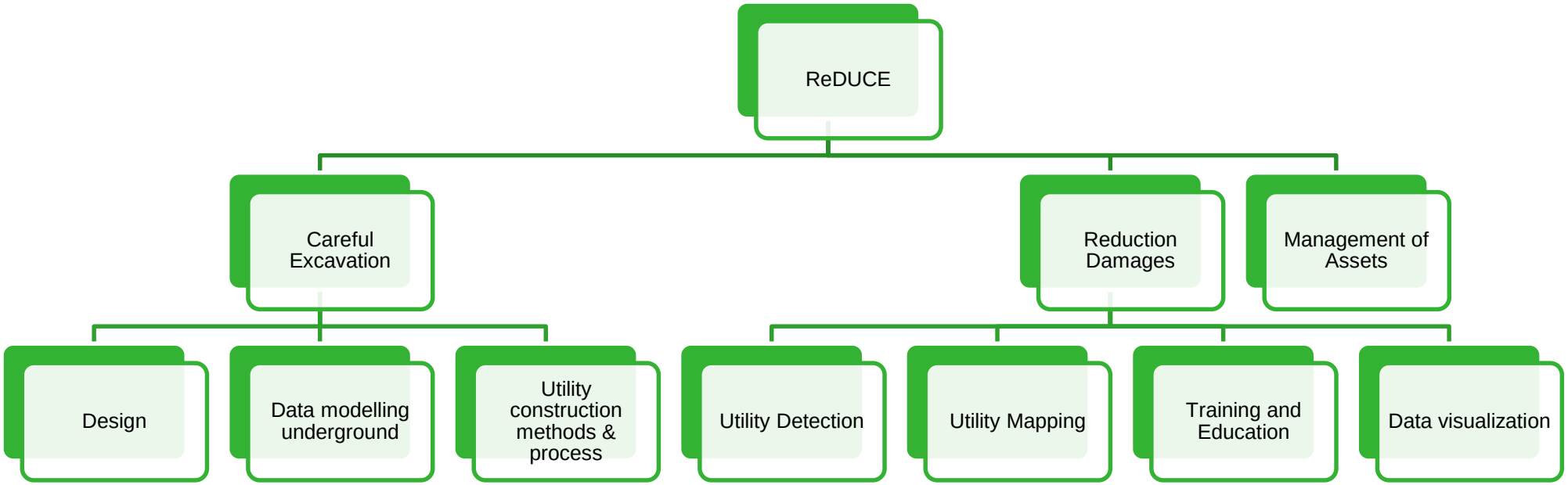
Information and Coordination issues

Issues addressed in ZoARG | ReDUCE

- Inaccurate, incomplete, fragmented underground utility information leads to …..
  - incorrect and incomplete design
  - incorrect and incomplete project tendering
  - surprises during projects, delay
  - orphaned cables, pipes and other structures
  - unknown and/or unwilling owners
  - unknown states and functionality
  - health hazards, excavation risk

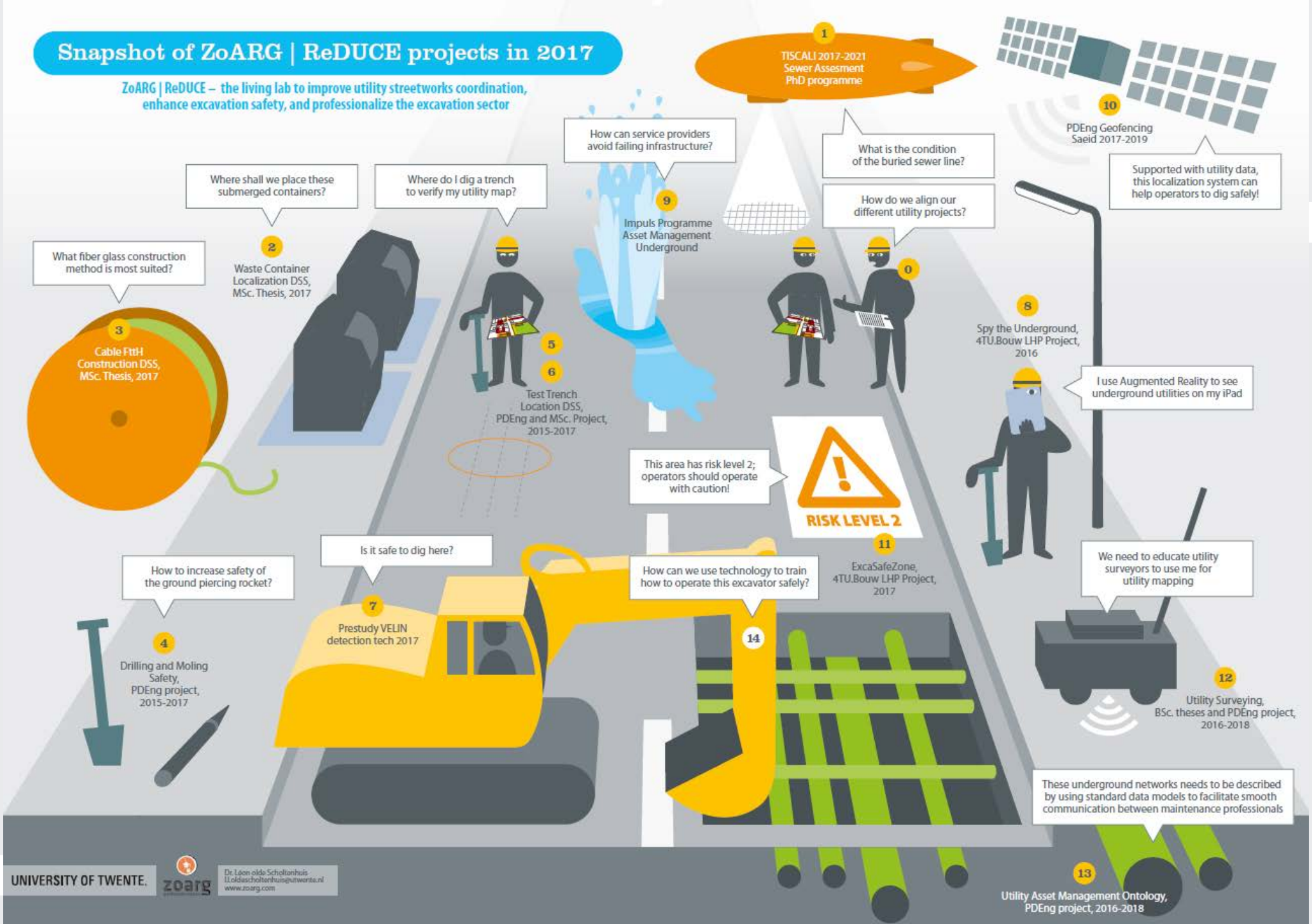
- Privatisation leads to ….
  - Lack of overall vision and strategy about underground
  - Risk shifting
  - Lack of cooperation on project level
  - Lack of control by the government

Our attention points …



Snapshot of ZoARG | ReDUCE projects in 2017

ZoARG | ReDUCE – the living lab to improve utility streetworks coordination, enhance excavation safety, and professionalize the excavation sector



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ReDUCE Team

Prof. André Dorée

Dr. Farid Vahdatikhaki

Paulina Racz. MSc.

Saeid Asadollahi MSc.

Dieuwertje ten Berg MSc.

Ramon ter Huurne MSc.

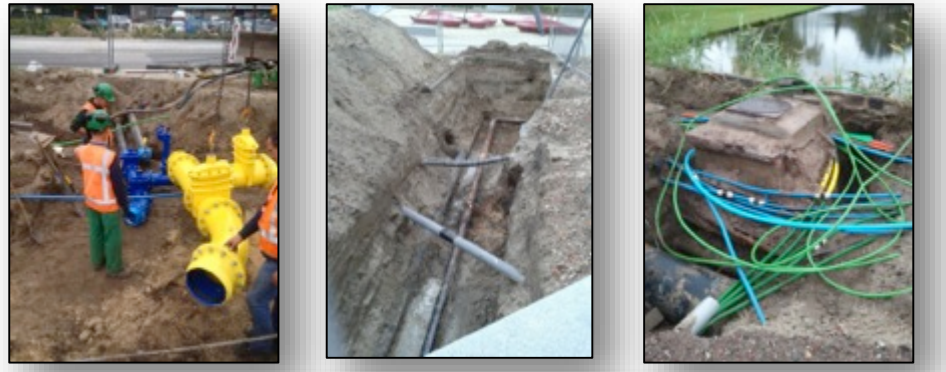
Dr. Léon olde Scholtenhuis

Fatemeh Mahmoudi P.D.Eng.

& since 3 months: Hengameh Noshari (PhD) on joint project

UT Campus is our *Lab*

- Training, evaluation and developement of technologies; (**to demonstrate**):
  - availability of the latest technologies & instruments (GPR, EM etc)
  - building showcases
- Living Lab as **meeting place**, offers
  - test bed and playing field
  - research facilities for students and companies
  - cross overs between research and practice
- **education and research**
  - Training facilities for '*Utility Surveyors*'(ism ROC Twente)
  - user experiences provide feedback to manufacturors



Selection of our projects

Information modelling and visualization for planning and design:

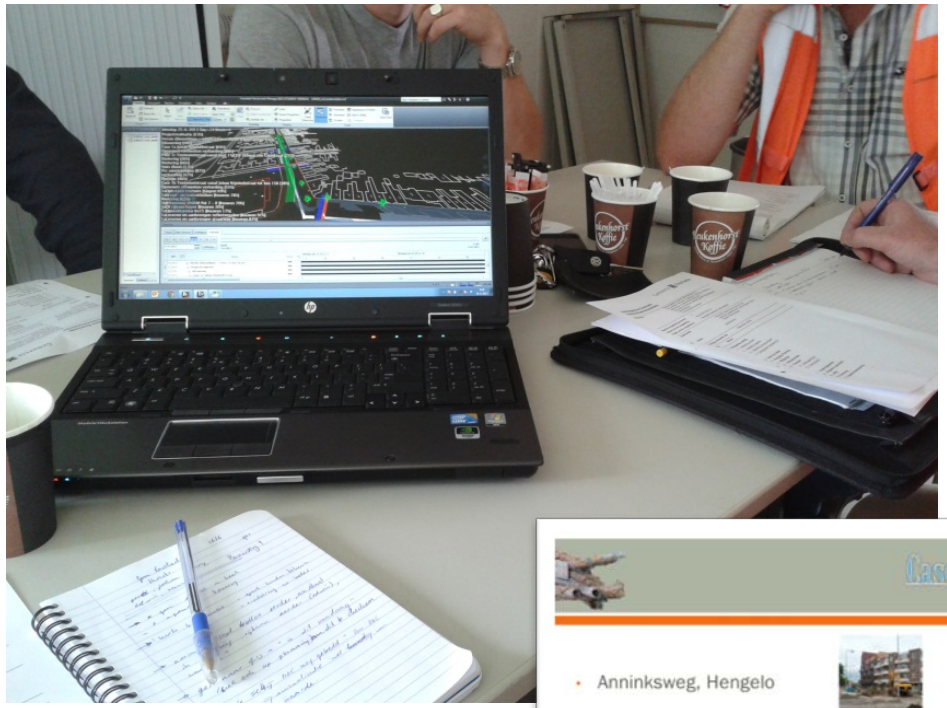
- 4D modelling
- Domain Ontology for Utility Asset Management
- 3D Fuzzy Utility Model in AR
- Construction Risk Heat Maps
- Trial Trench DSS

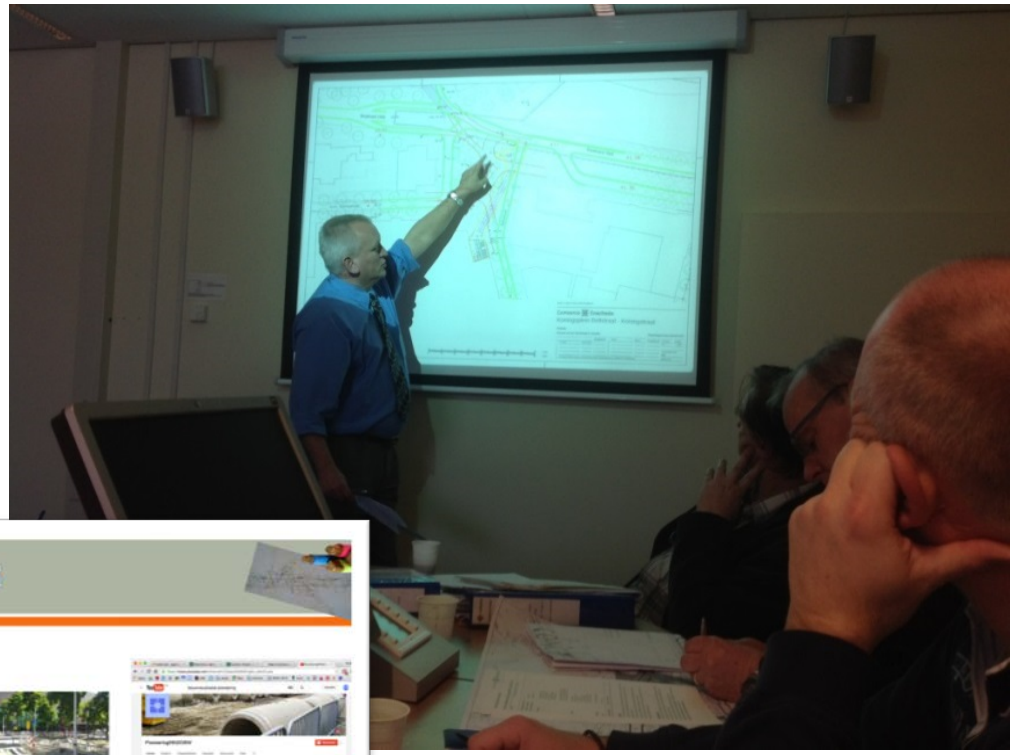
‘Smart Construction Site technology’

- Review of Detection and Mapping Technologies
- Geo-fencing Technology for Pipeline Safety
- Safety Simulation & Training Development
- Sewer Condition Assessment

4D Modelling to support multi-stakeholder construction work

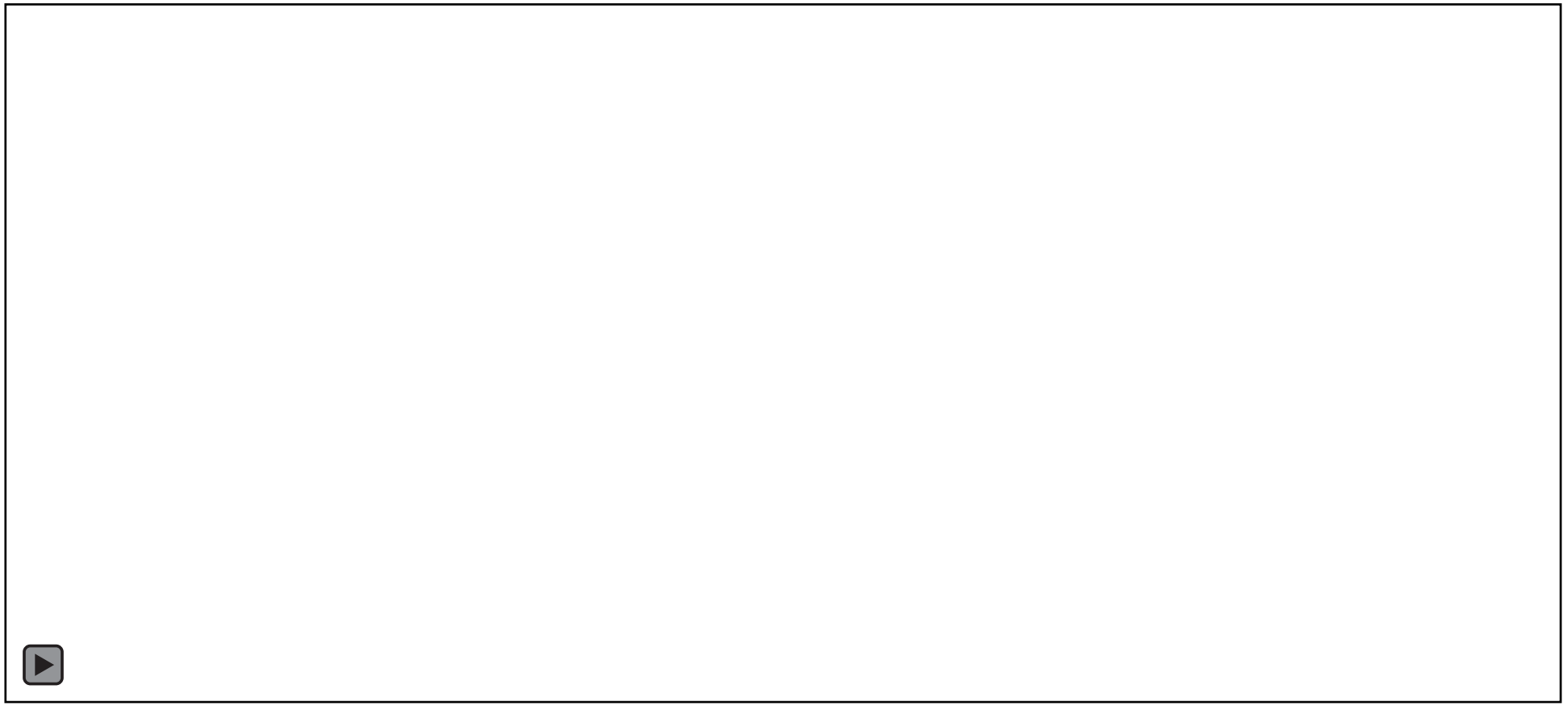
PhD Project Léon olde Scholtenhuis (2012-2015)



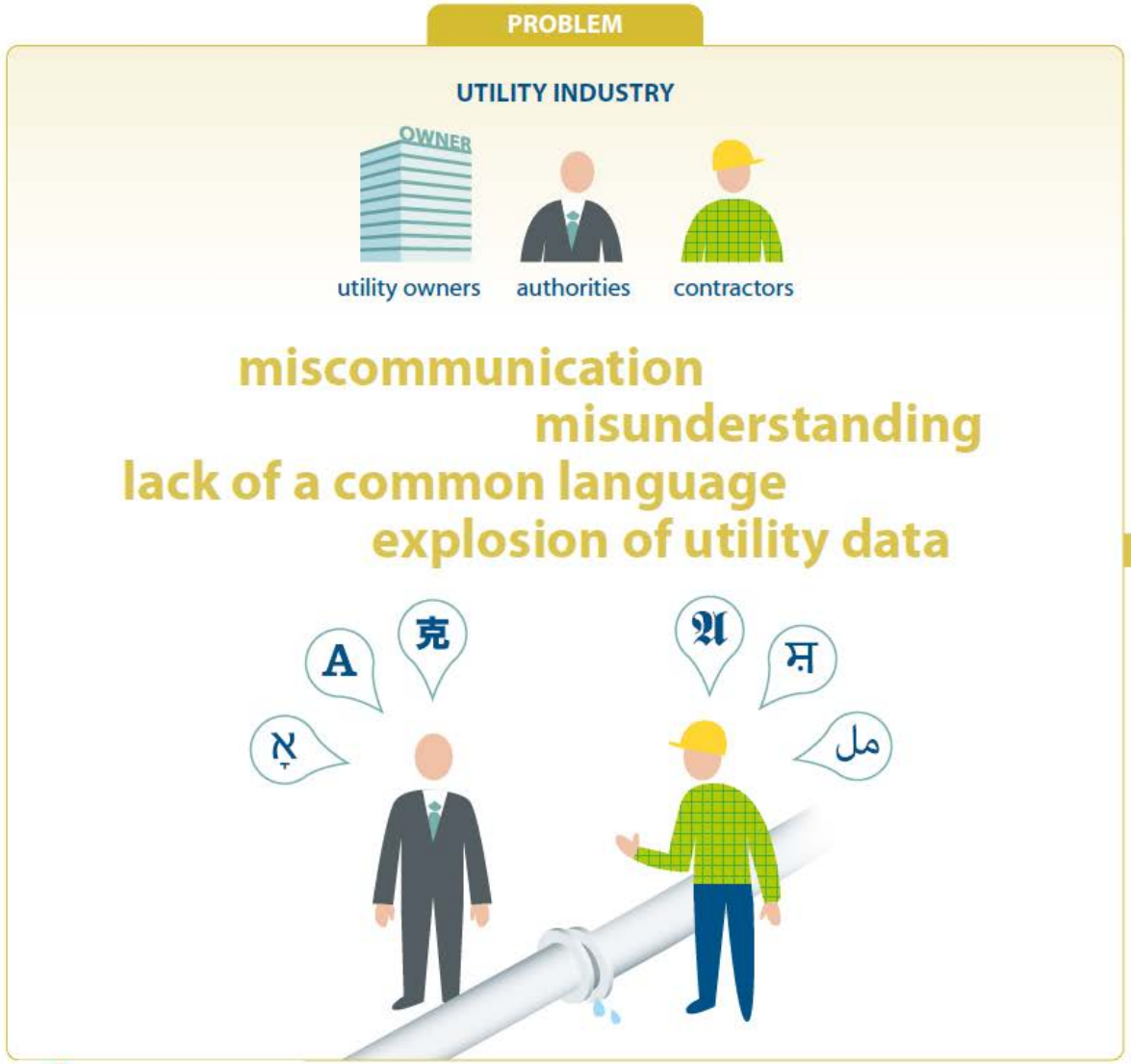


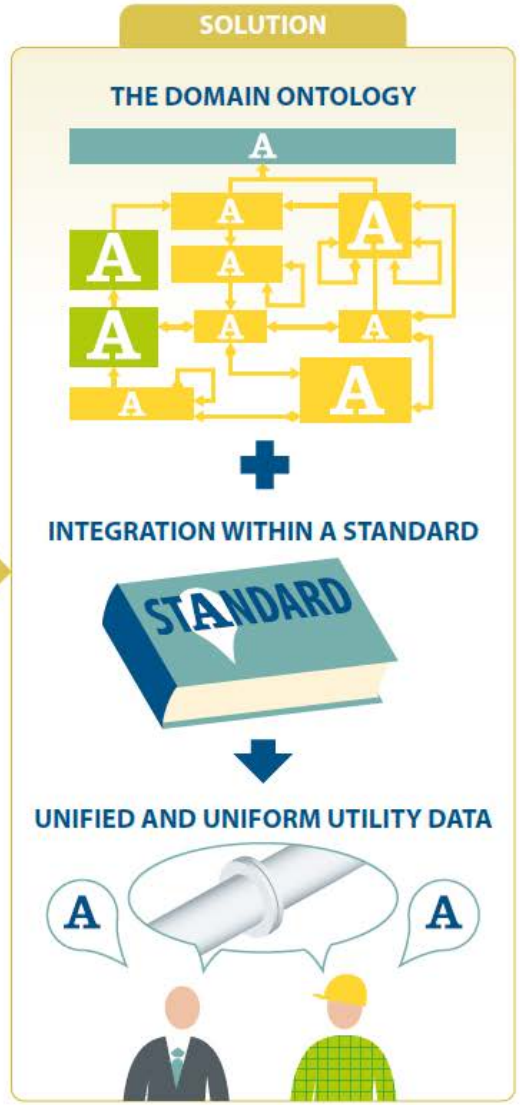
4D Modelling: example

PhD Project Léon olde Scholtenhuis, Case Reconstruction Koningsplein



Domain Ontology for Utility Asset Management





Ramon ter Huurne
r.b.a.terhuurne@utwente.nl

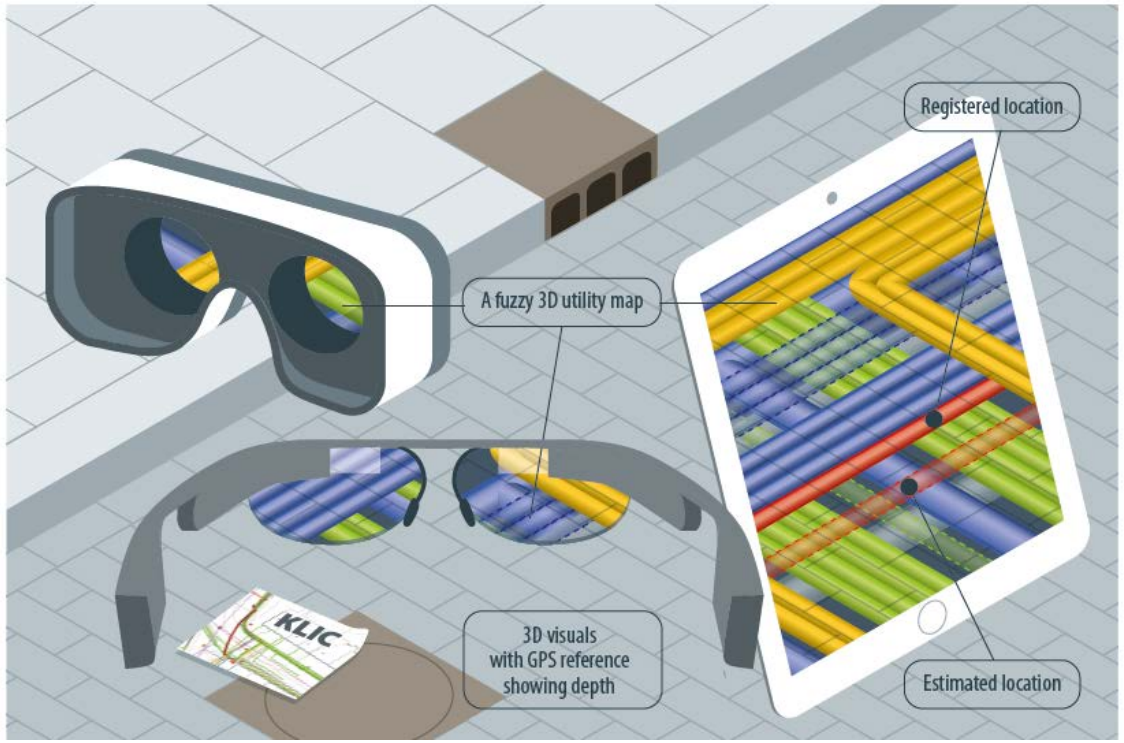
PDEng-project:

Bottom-up development of Utility Asset Management Information model

Align with ongoing company and GIS standards

3D Fuzzy Utility Model in AR

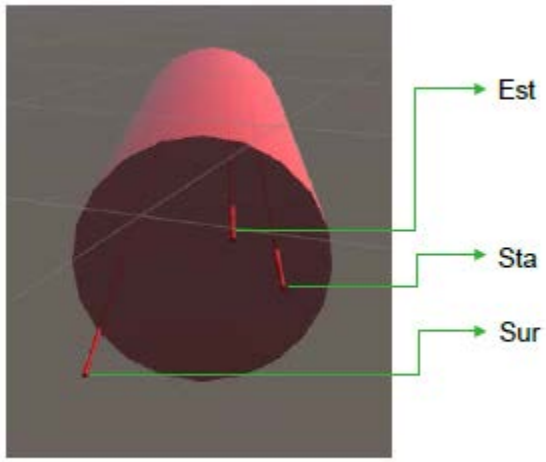
4TU.Bouw
center of excellence for the built environment



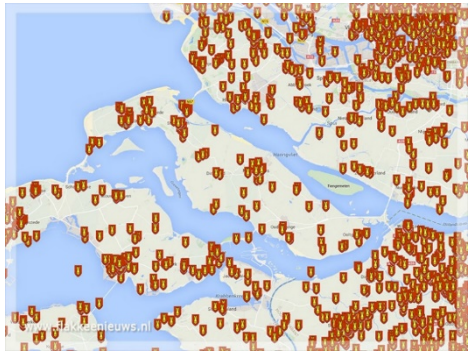
Short Research Project
Dr.-Ing Sisi Zlatanova (TU Delft)
Xander den Duyn (MSc graduate, TUD)
Léon olde Scholtenhuis (Utwente)

Development of a data model
that captures underground data uncertainties

Visualization in AR (proof of concept)



Construction Risk Heat Maps



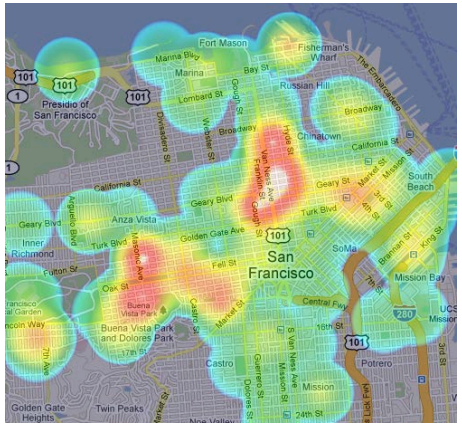
Short Research Project

Dr. Ir. Léon olde Scholtenhuis (University of Twente)

Dr. Farid Vahdatikhaki (University of Twente)

Dr. Dipl.-Ing. Sisi Zlatanova (Delft University of Technology)

Dr. Dipl.-Ing Jakob Beetz (Eindhoven University of Technology)



Trial Trench DSS

PDEng-project:

Elicitation of implicit logic for localizing trial trenches on-site

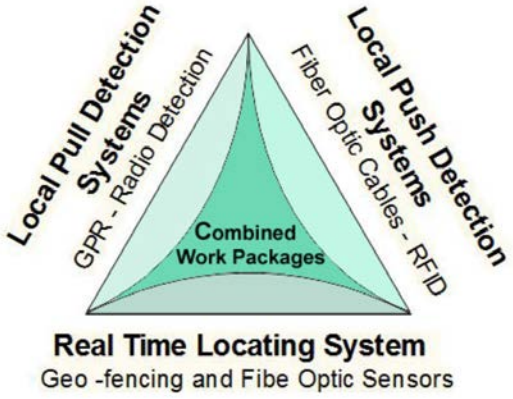
Serious games with practitioners

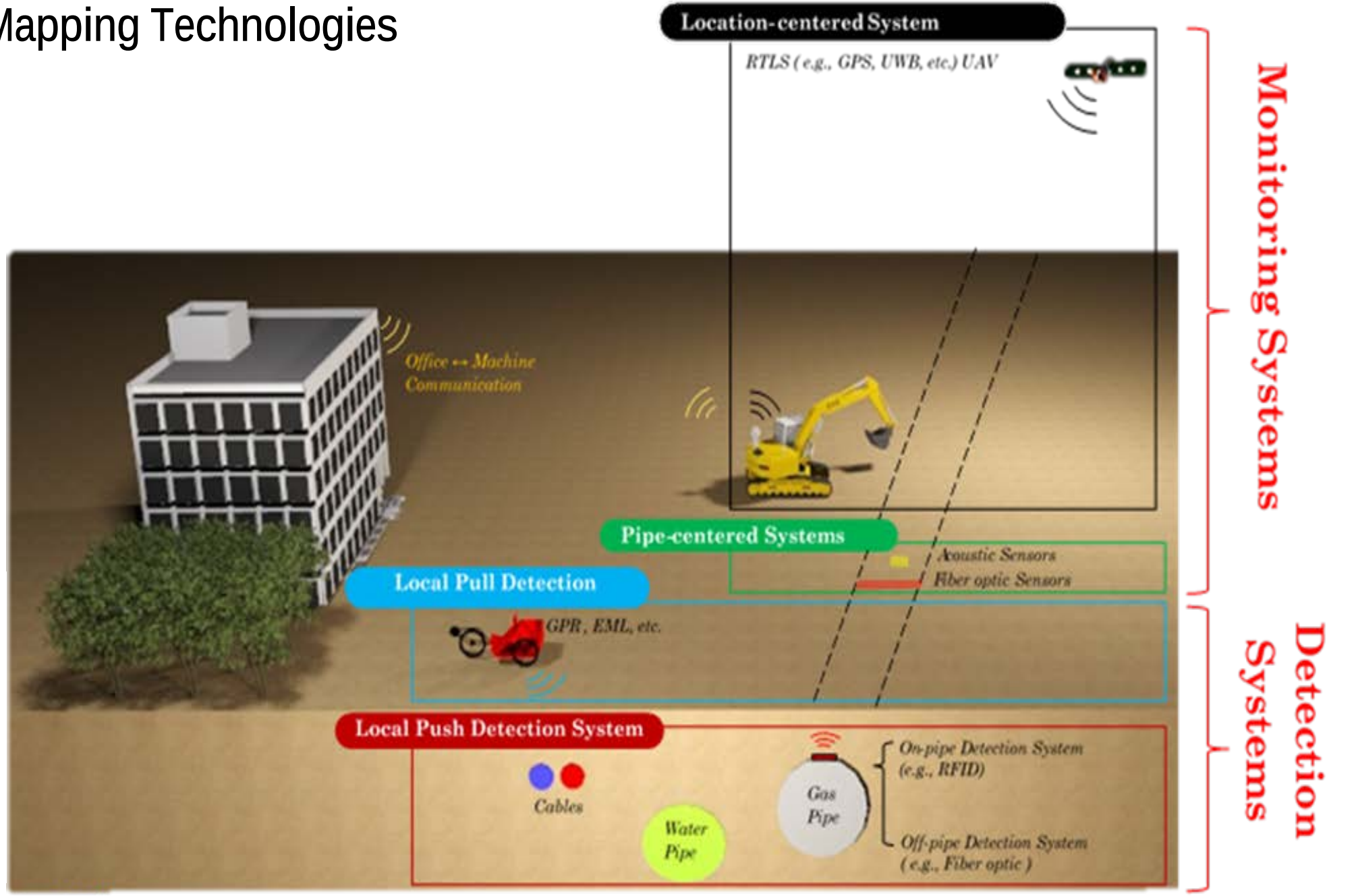
Development of a Decision Support Tool that aids in determining trial trench locations

Detection and Mapping Technologies

Short Project

Review of technologies for Onsite Excavation Damage Prevention



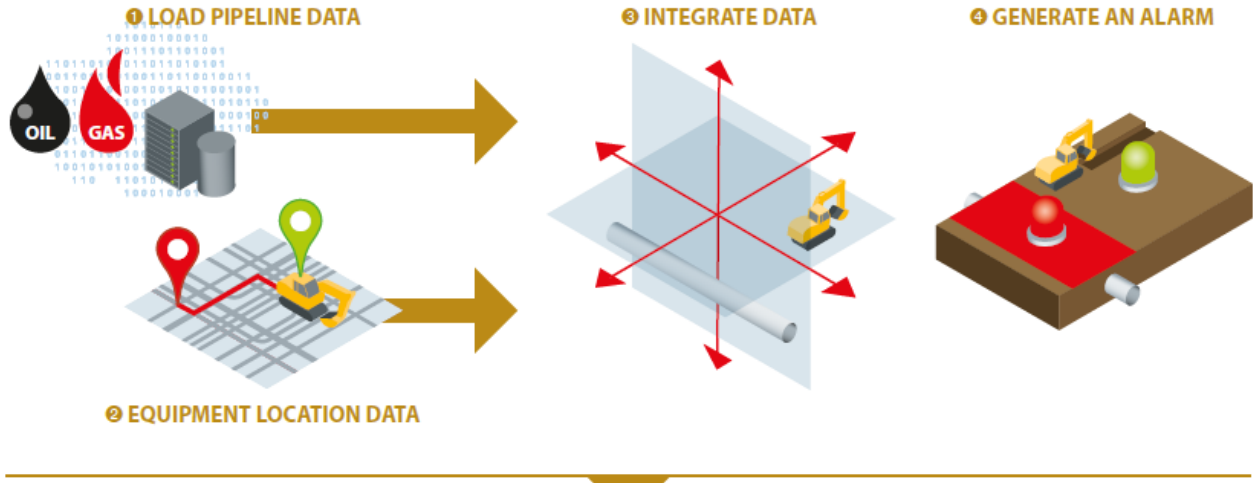


Geo-fencing Technology for Pipeline Safety

Problem
Pipeline incidents in the Netherlands.

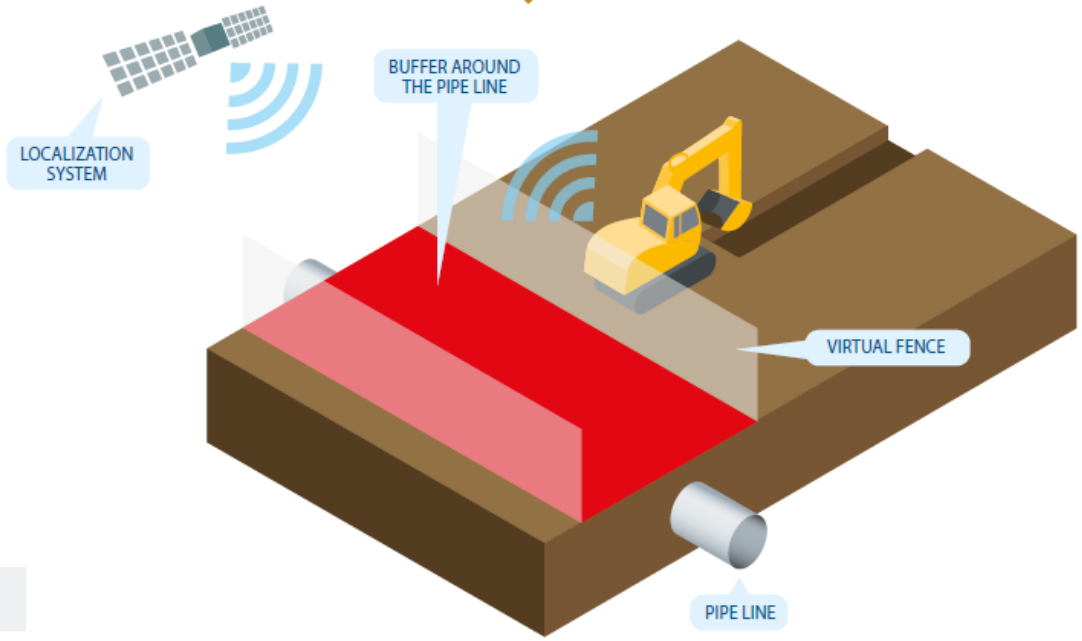
Cause
Third parties (the excavator driver not employed by pipeline Company) cause 50% of gas pipes incidents and 30% oil pipe incidents.

Why
Existing safety systems are:
- Not affordable by third parties
- Not user friendly



Goal
Develop a safety system which is:
- Affordable by third parties
- User friendly

Challenges
- Compatible with the existing pipeline data ❶
- Low cost ❷
- False alarm rate ❸
- Mountable on excavator ❹



PDEng-project:

Development of affordable geofencing system for protection of high pressure pipelines

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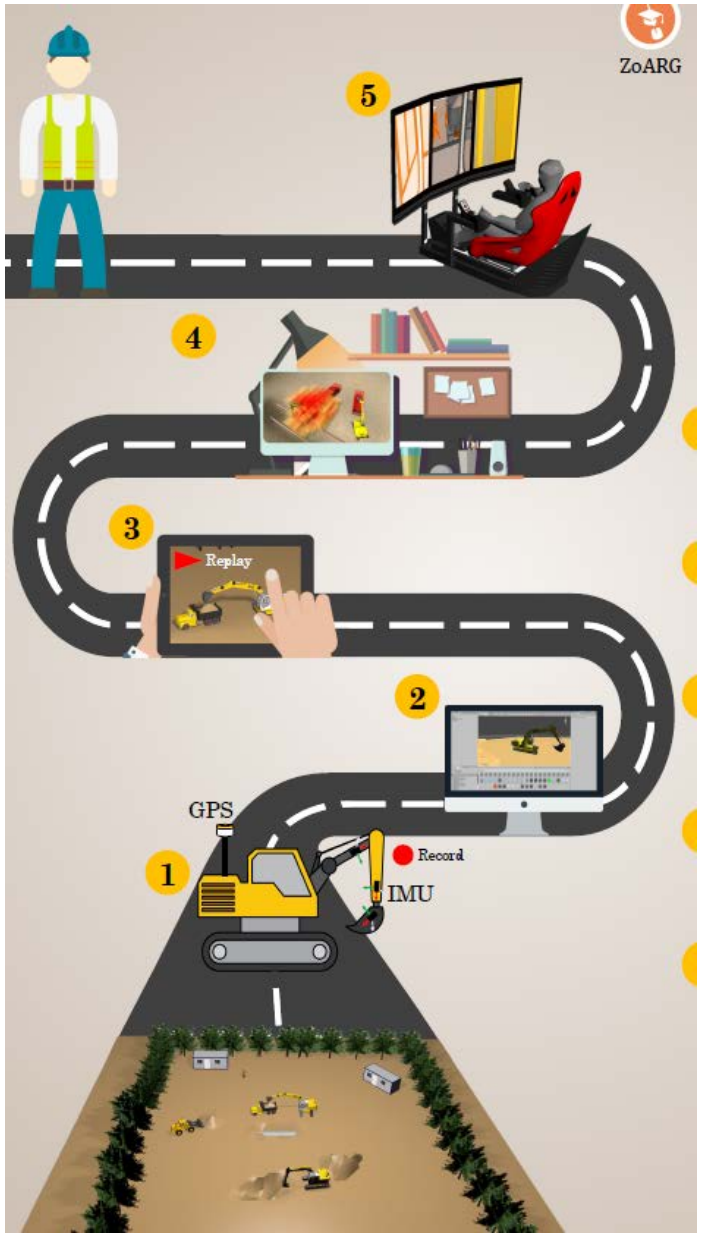
Saeid Asadollahi
s.asadollahidolatabad@utwente.nl

Safety Simulation & Training Development



Education Research Development

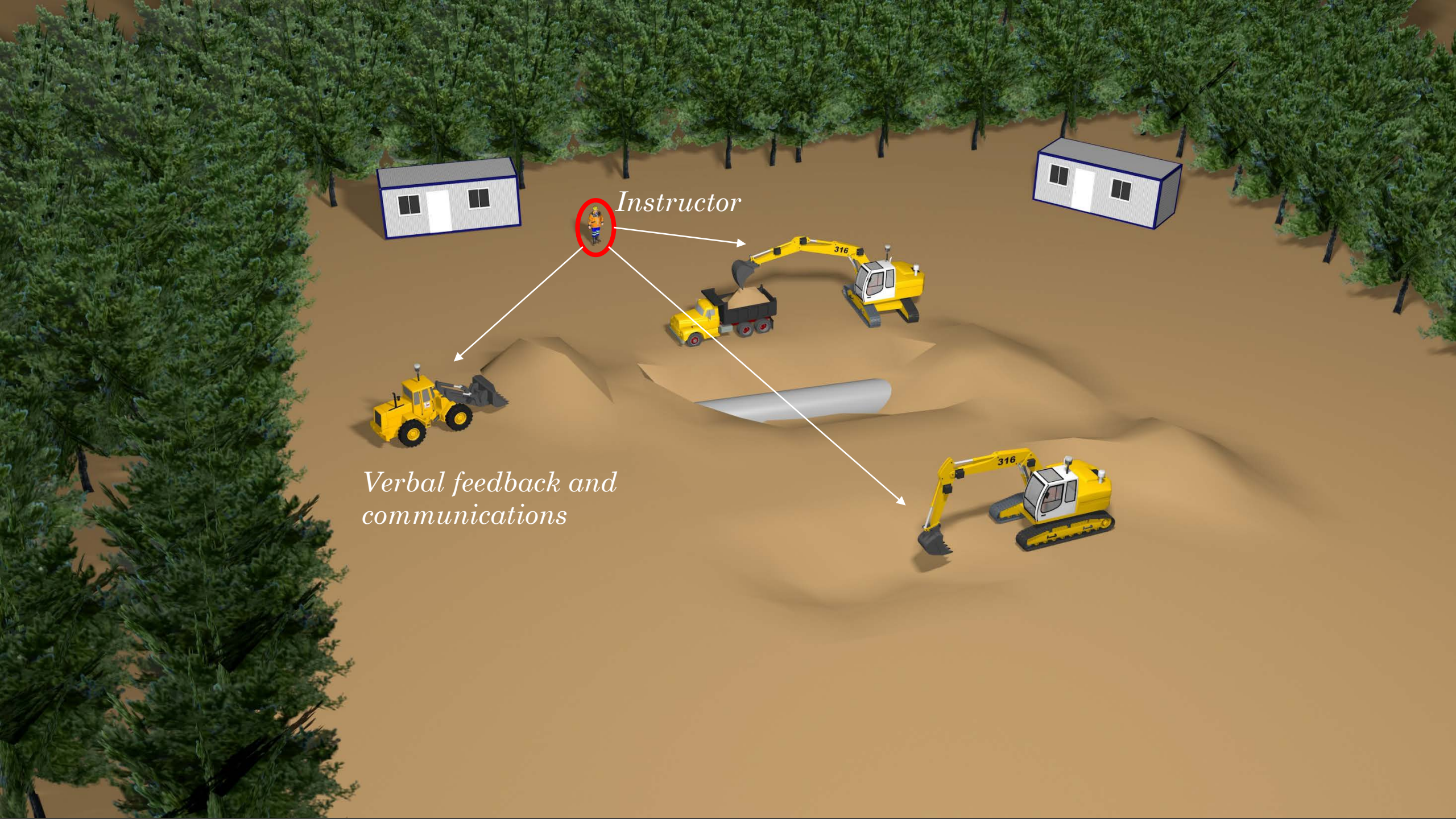
Large project with Excavator Operator School SOMA

Development movement tracking system for excavator machines

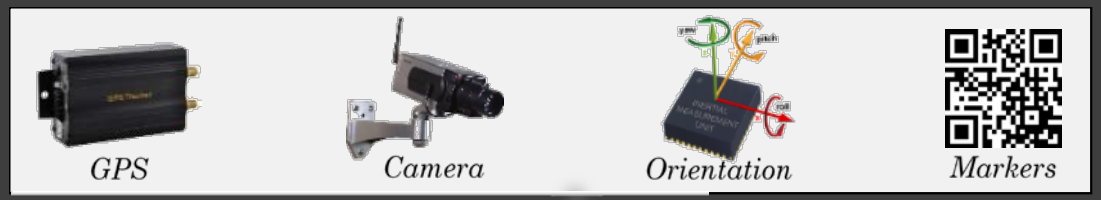
Development for safety training

start to

When should we rethink the way we train construction workers?

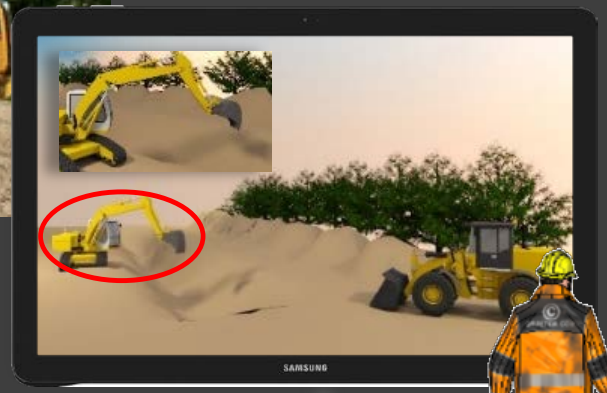

Instructor
316
316
Verbal feedback and
communications

Pilot Projects: Feedback Support System



Equipment Sensorization

Scene Reconstruction



Practice on Realistic Simulation

Improved Onsite Training

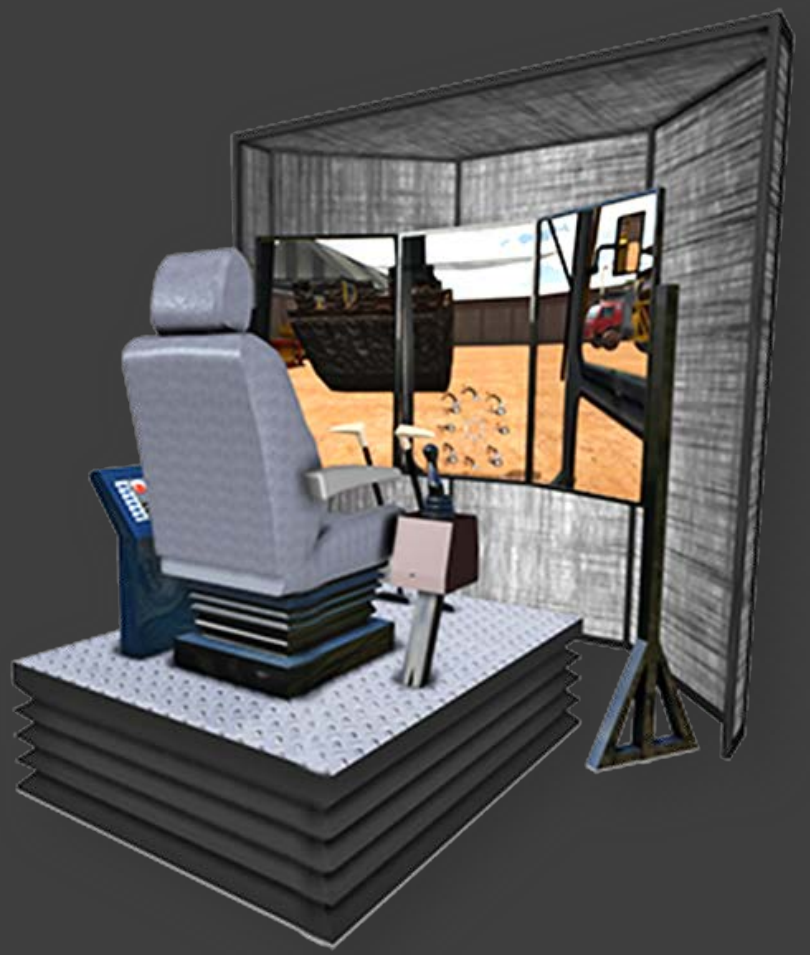
Feedback Support System

Pilot Projects: Feedback Support System

Data Collection

Captured and Virtualized

Pilot Projects: Next Generation of Training Simulators



Pilot Projects: Next Generation of Training Simulators

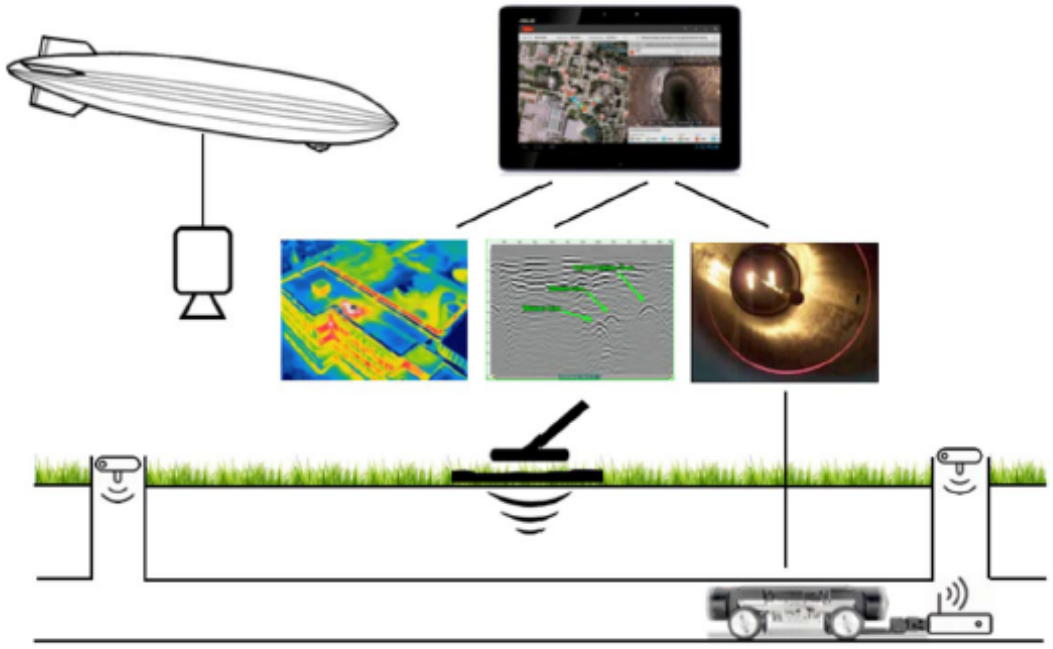
Our Vision

Sewer condition assessment

Collaboration with prof. van der Meijde

Netherlands Organisation for Scientific Research

Technology Innovation for Sewer Condition Assessment – Long-distance Information-system (TISCALI)

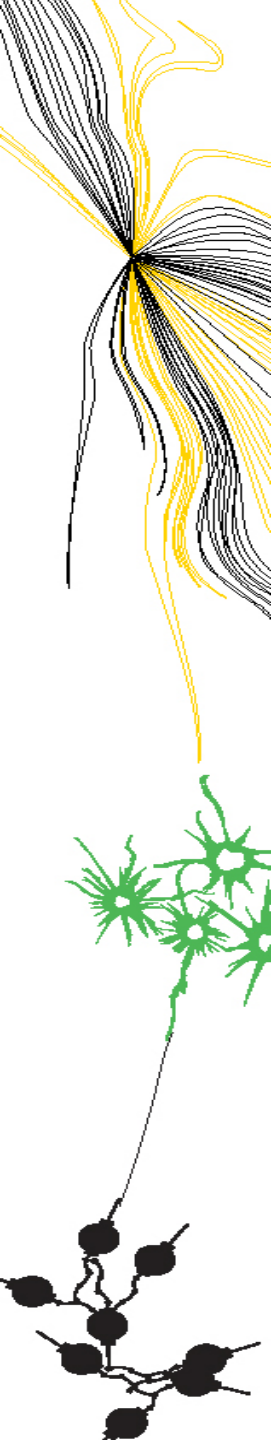


PhD programme (2 students)

Remote Condition Assessment

In-Pipe Condition Assessment

Development of an Information System



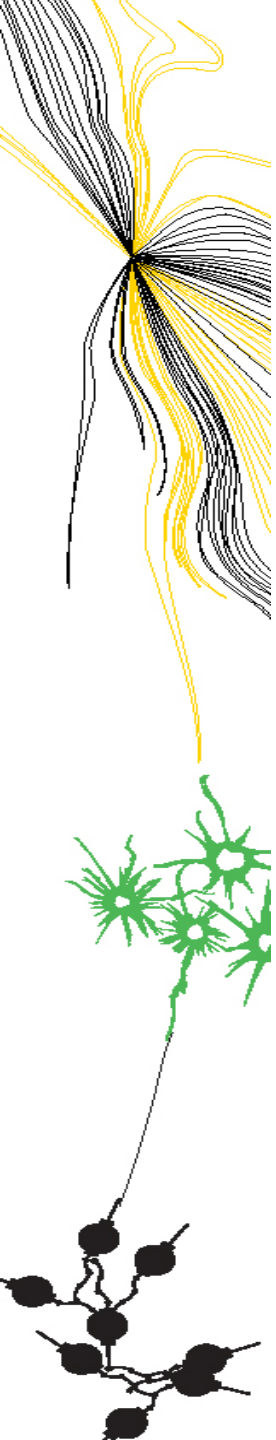
IN A NUTSHELL

Our (domain) knowledge about:

- Construction processes
- Empirical research
- Engaged scholarship
- Technology implementation

Synergy with disciplines:

- Data visualization (mixed reality)
- Data modelling (semantically rich 3D-utility data)
- Maintenance robotics (pipeline inspection)
- Asset Management (underground asset management systems)
- Surveying and sensing (geophysics)



ON OUR WISH LIST…

- Build a **strong research community** around (shallow) underground engineering
  - Data model and technology development (technology-driven)
  - Implementation and evaluation (construction management)
- Apply collaboratively for grants (national, international) based on our mutual interests
- Starting point:
  - Special issue IJ3DIM
  - EUopstat proposal (Carl)
  - Today!