

The Insiter project:

Development of intuitive self-inspection techniques

The Insiter project is a new promising research project within the EU research programme 'Horizon 2020' that started in December 2014 and will run for 4 years. The key innovation of Insiter is the development of intuitive and cost-effective tools for self-inspection and self-instruction with the use of Augmented Reality (AR) and BIM. Since TVVL has a strong interest in the professional development of continuous commissioning (Cx) processes and tools, new relevant developments within the project will be published in TVVL-magazine.

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INSITER INTUITIVE
SELF-INSPECTION
TECHNIQUES

The critical mass of Energy-efficient Buildings (EeB) in Europe by 2020 will be achieved through sustainable industrialization of high-performance architectural, structural and building-service components. However, realizing the targeted performance in design is hampered by critical shortcomings during on-site construction and refurbishment that cause a lower built-quality and sub-optimal energy-saving during the building lifecycle.

The Insiter partners work together to eliminate the gaps in quality and energy-performance between design and realization of energy-efficient buildings made of prefabricated components. They will develop a methodology and a supporting toolset for self-instruction and self-inspection by construction workers, subcontractors, component suppliers, and other stakeholders during on-site working processes. The new concept of self-inspection and self-instruction that is performed simultaneously with on-site processes has a strong contrast with the traditional post-inspection approach.

Through new self-inspection techniques, the project will fully leverage the energy efficiency potentials of buildings based on prefab

components, from design to construction, refurbishment and maintenance. It will scale-up the use of BIM for standardized inspection and commissioning protocols, involving all actors in the value-chain. The use of AR – that connects virtual and physical buildings in their environments at real-time – aims to ensure that the targeted performance in the design model is realized.

■ EXPECTED IMPACT

Insiter will substantially enhance functionalities and capabilities of measurement and diagnostic instruments (like portable 3D laser scanners, thermal imaging cameras, acoustic and vibration detectors, real-time sensors) by means of a smart Application Programming Interface (API) and data integration with a cloud-based Building Information Model (BIM). The triangulation of Geospatial Information, Global and Indoor Positioning Systems (GIS, GPS, IPS) will support accurate and comprehensive Virtual and Augmented Reality (VR and AR).

The challenge is not in the development of new technologies, because the required technology is already available. The challenge is to

combine these new technologies and adapt them for direct use by skilled workers at the building site without negative implications on production time and process. The enhancement of innovative systems will eventually change our daily process radically, on-site and off-site. This will lead to a considerable reduction of the mismatch of energy performance between design stage and commissioning stage.

One component of these new solutions and tools is the development of an augmented reality (AR) application for self-inspection and self-instruction. The AR application will give intuitive support and guidance by the visualization of digital planning data, 3D building models and components, based on captured real-time physical information and its associated BIM data. Moreover, the user will be able to display enhanced planning data from diagnostic instruments and instrumentation devices, like thermal images. Relevant planning and instrumentation data will be integrated into the BIM to become available and accessible for new Insiter tools and the AR application. Meaningful use cases with an interactive user experience are realized with the support of



AR Application Example with 3D Building Model (©Fraunhofer IGD)



Insiter kick off meeting in Delft (©DEMO consultants)



Intuitive Self-Inspection Techniques using Augmented Reality for construction of energy-efficient buildings made of prefabricated components (©DEMO consultants)

advanced object recognition and simultaneous localization and mapping based tracking technologies. Thus, the new AR application will bring benefits for daily work in the field of building design, construction, inspection and maintenance. There are various hardware components available enabling AR, the focus of the project is on cost-effective interactive support by using mobile or handheld devices.

■ INTEGRATED APPROACH

Insiter will develop an integrated approach on learning for and from self-inspection. Self-instruction will play an important role in that approach. Development will take place parallel to the development of the tools and methodology.

Self-inspection: encourages, enables and equips construction workers to check their own working processes and the results respectively, both individually as well as peer-to-peer with other workers.

Self-instruction: is a pro-active approach to provide craftsmen and professionals with interactive guidance during their working processes. Self-instruction is facilitated on the workers' mobile devices, with continuous updates based on both pre-planned (designed) process as well as real-time feedback from self-inspection. Self-instruction prevents wrong actions, and helps the workers to rectify any error immediately.

During the project we will establish a community of practice (CoP) in conjunction with the European training network in the on-going EU BUILDUpSkills and PROF-Trac program. Where possible and appropriate we will prepare and introduce skill-oriented professional training and certification programs for craftsmen and building professionals in countries where consortium partners are located. Last but not least based on lessons learned we will formulate recommendations for standardization, and provide input to the relevant working committees for the development of practical guidelines, technical norms and standards.

■ PLANNED DELIVERABLES

The first year, 2015, is a year of analyzing. Insiter will identify existing bottlenecks, most frequent errors and shortcomings in skills in the construction processes across the EU. Aggregated BIM will be developed with an object library allowing suppliers and manufacturers to upload their products. Furthermore a selection of the most relevant existing measurement and diagnostic equipment and self-inspection software and tools will be made. In 2016 self-inspection techniques will be developed in coherence with an efficient construction process workflow. These techniques cover the effective use of hardware tools and the prototype software will be ready as a draft Alfa version. Data of real case studies will be fed into BIM and prepared for growth / lifecycle use of BIM. This year Insiter will start organizing trainings on self-inspection with known tools and learning from building errors. In 2017 Insiter will focus on field test and validation. Software tools will be progressing to a Beta version. BIM for construction will be validated for self-instruction and self-inspection for each actor or discipline. Training will focus on workplace learning with self-inspection methods and the use of BIM; In the last year 2018 research will focus on field on-site validation at commissioning / handover phase. Validated prototype methods, hardware and software are brought together in the 'self-inspection complete solution package'. Self-inspection methods (i.e. procedures, protocols, manuals) as well as assessment and calculation methods are presented as input for EU normalization or standardization. Skill-oriented professional

training and certification programs are prepared and introduced to workers/professional associations. The project team will publish regular updates about the new developments and experiences in the project. Where relevant articles will be published in TVVL magazine.

■ PROGRAMME

The Insiter consortium consists of 14 partners: 10 industrial partners (3 large companies + 7 SMEs) and 4 research organizations, that represent 6 EU countries. The Dutch partners are Demo Consultants, DWA, ISSO and SBRCURnet. The consortium has been established by partners of earlier international research and co-operation projects (e.g. Proficient and BuildUpSkills) added with new partners from their national and international networks.

Insiter is a research project within the EU research programme Horizon 2020, with a particular attention to quality-gap and performance-loss between design and realization both in new construction as well as refurbishment of Energy-efficient Buildings (EeB). Horizon 2020 is the biggest EU Research and Innovation programme ever. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

