

Project Proposal “Virtual Guidance System” for Installation, Operation and Maintenance within the Joint Czech-German Project on Industry 4.0

Technology Overview

The virtual guidance system, envisioned within the joint Czech-German Call on Industry 4.0 will support technicians and operators for assembling and maintaining technical equipment, machinery and facilities through visual technologies. In particular, an operator will capture a particular equipment or machine under construction or maintenance, using a tablet. For the recorded videos and images, a content-based analysis is carried out, where parts and components are robustly identified, using a new adaptive 3D object matching approach. This also includes recognition of partially occluded or aged/corroded parts by adapting the analysis methods to the very specific databases of the component-supplying company. The identification process will be optimized through adaptive analysis, e.g. learning-based approaches. The identified objects from the database will then be overlaid (mixed reality) on the tablet to visualize components and guide an installation or maintenance process. The system can be applied within a company as well as an external construction site. It also provides personnel in training phase to carry out supervised work through the tablet and can thus be used for education as well. Within this project, the envisioned virtual guidance system will be developed together with Czech and German SMEs.

Ideally, a cooperation between Czech and German SME partners already exist and the envisioned system can be developed with respect to the respective cooperation scenario, e.g.:

- SME 1 delivers systems and components to SME 2. Here, the component database of SME1 will be used as analysis base for our visual identification process and the system applicability will be evaluated in SME 2. In this scenario, SME 1 will develop technology and interfaces to access its component database and other required sensory data via the tablet, HHI will develop robust object detection and similarity analysis technology, SME 2 will develop the visual overlays (mixed reality representation) and carry out usability and applicability assessment.
- SME 1 and SME 2 are jointly developing technology and apply/install their joint technology at third party’s sites. Here, the relevant component database (from both SMEs or the relevant SME) will be used and the system applicability be proved at the respective installation site. The partner role of HHI remains the same as in the previous case. The roles of SME 1 and SME 2 will be assigned according to expertise and preference.

Consortium:

The following partners with respective expertise shall form the consortium:

1. Czech SME in industrial areas of: component construction, civil engineering, plant construction, automobile supply, technical maintenance, energy management, facility operation or similar, ideally with an existing partnership to a German SME. The partner role in this project depends on the type of cooperation, as described above in the technology section.
2. German SME, similar as described above.
3. Research Institute Fraunhofer HHI with the tasks to develop robust visual 3D object detection technology under constrained component database support, where the latter is provided by the respective SME(s).
4. Optional - Czech research institute/university: Recommended, if suitable and complementary research is carried out, e.g. in the area of scalable transmission, system optimization, subjective assessment or end user evaluation

Expertise of Fraunhofer HHI - Image and Video Understanding Group

Fraunhofer Heinrich Hertz Institute is a leading Institute in the areas of communication nets, photonic components and multimedia systems. Within its business section of image processing, a range of world-leading technologies and standards are researched and developed, including video compression, transmission, 3D visual technologies, visual analytics and machine learning.

In this business section, the video understanding group develops technologies for robust and fast image and video analysis (feature detection, temporal structure detection, 3D feature description with primate matching, depth and stereo analysis, sports analysis), content analysis (video summarizations, overviews, time lapse, spatio-temporal scene overviews, concept detection) and smart data for Industry 4.0. Some of the technologies are included in applications and products for online portals, libraries, product identification and intellectual property protection.

Target Program

Joint Czech German Research Project in Industry 4.0:

- Industrial Research and Development, Application Area: Virtual technologies
- Consortium: at least one SME from CZ and one from DE, in addition one research institute (FHG-HHI), possibly additional CZ research partner
- Funding: Technologická Agentura České Republiky (TAČR) for CZ-partners and Ministry of Education and Research (BMBF) for DE-partners
- Duration: 24 month

Contact (Fraunhofer HHI)

Dr. Karsten Müller, Fraunhofer Heinrich-Hertz-Institut, Image and Video Understanding Group

Einsteinufer 37, 10587 Berlin, Germany

email: karsten.mueller@hhi.fraunhofer.de