Coupling of Digital Twin and Physical Tracking System

Dr. Henry Wojcik, 3D Interaction Technologies GmbH, Dr. Attila Römer, Metirionic GmbH, Dr. Thomas Daffner, Umweltbüro Vogtland GmH

(1) Abstract

Marrying 3D real-time visualization to physical tracking systems via an interface allows you to visualize what is happening or being happening at a particular location at a particular time. The already required comparison between tracking values and environment is extended here by referencing to planning data such as 3D CAD or 3D scans, thus promoting congruence between the numerous documents and „worlds" that are usually already linked in some way to this planning data (third party information).

Practical applications include production lines and large-scale operations such as a „digital mine". Wherever documentation, live operating data and live processes have to be „viewed", see Figures 1 and 2.

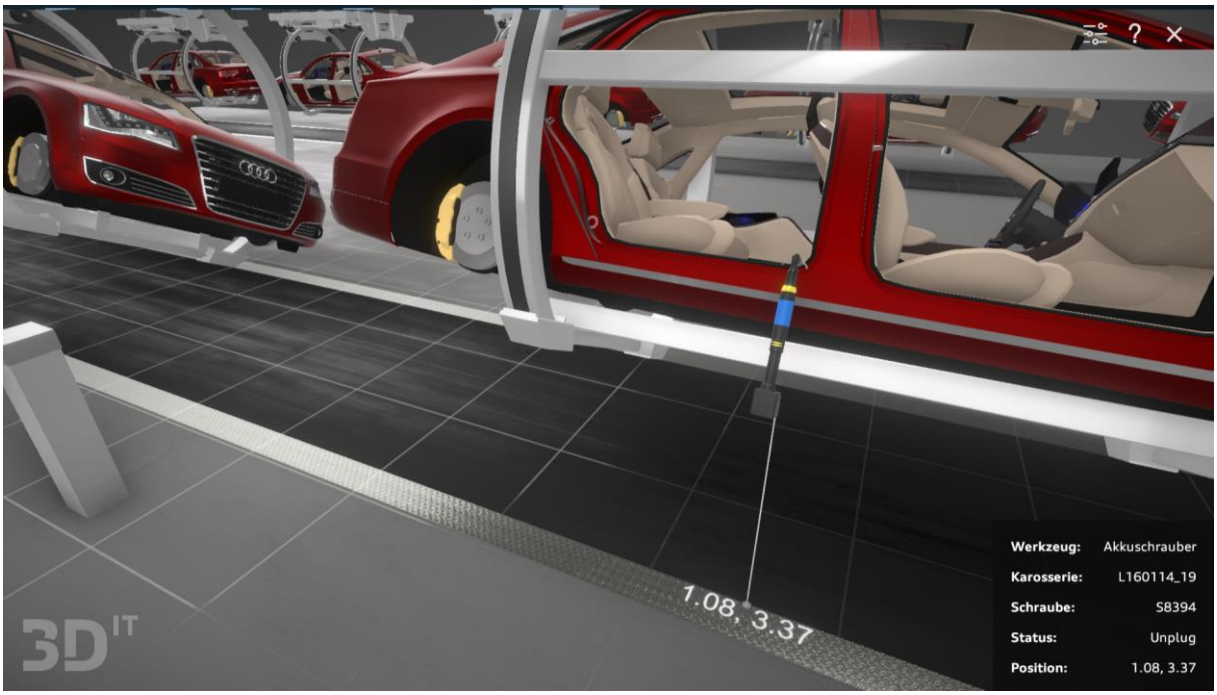

Figure 1 Detail of a characteristic production line incl. interface to the tracking system (cordless screwdriver, release of the action by adjustment of position)

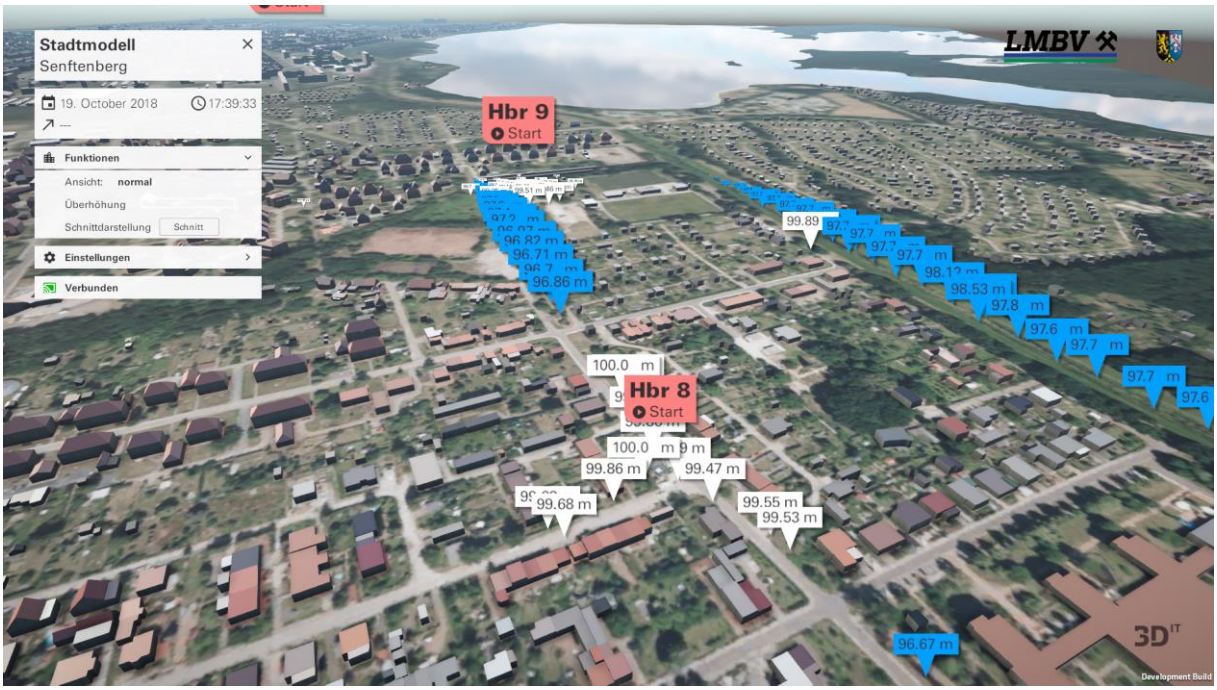

Figure 2 Digital terrain and city model plus integration of large-scale technical systems and sensors; query via OPC/UA interface in 3D real time; control possible; extrapolation of third variables (sectional views possible, also display of documents (digital twin). Courtesy of the project partners LMBV and UBV

(2) Technical background- 3D-Computergraphics

Originating from game technology, 3D real-time representation is now established to convey an idea of complex contexts in an intuitive mode, i. e. one that meets the needs of people and the experience of the real world. Known catchwords such as Virtual Reality (VR) or Augmented Reality (AR) are variations of these, depending on where a display is installed or used.

Figure 3 How do we explore complex things?

(3) Technical background - origin of 3D-models

3D real-time visualization is based on 3D planning data, CAD, digital city and terrain models (DGM), 3D scans. The term „real-time" signals here that the imaging individually selected by the user is calculated (rendered) within milliseconds on the terminal device, not already before, as with images and videos. The performance of 3D engines is much higher than that of simulation and design programs. This is mainly due to the fact that not parametric CAD data (mathematical description e. g. radius & angle) are still converted there, but triangulated data are used („polygons"), which in turn can be effectively simplified, especially in their data volume can be reduced.

(4) Added value by coupling(s)

The charm consists in particular in enriching this coupled solution additionally with database information, for instance from ERP or control systems, or from Building Information Modeling (BIM) systems; and finally in displaying context-related only those information which are relevant for a position. The trigger here is bilateral: On the one hand, the space viewed by the user is limited and continuously visualized down to the desired depth of detail (without breaks); on the other hand, the dataset of coordinates supplied by the tracking system ensures that certain objects and information are displayed or incorporated. This removes the black box that is purely a tracking tool and ultimately raises measurement values for outsiders.

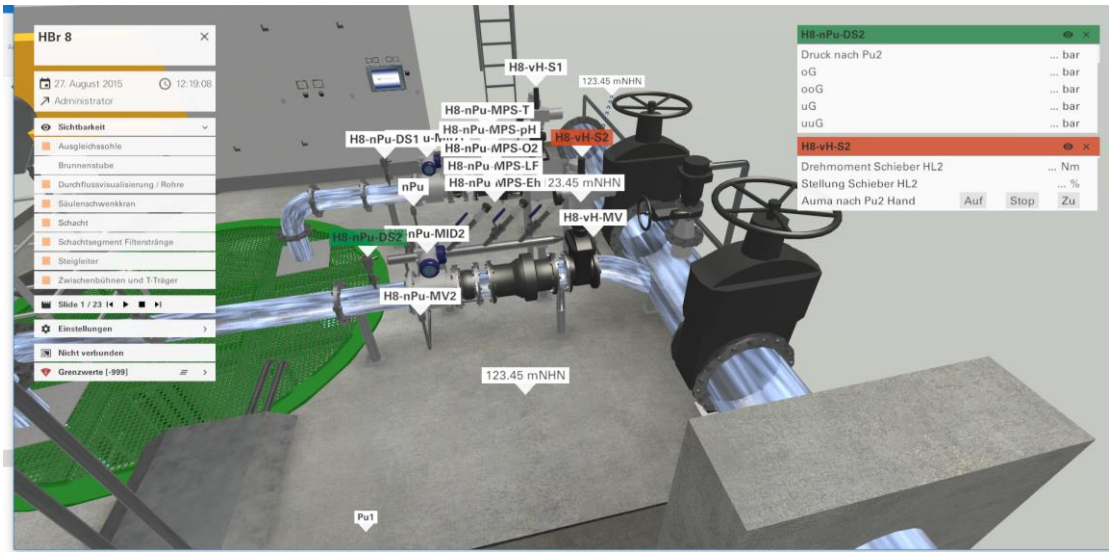

Figure 4 Enhancement of the 3D real-time model with local context-related information (third party information)

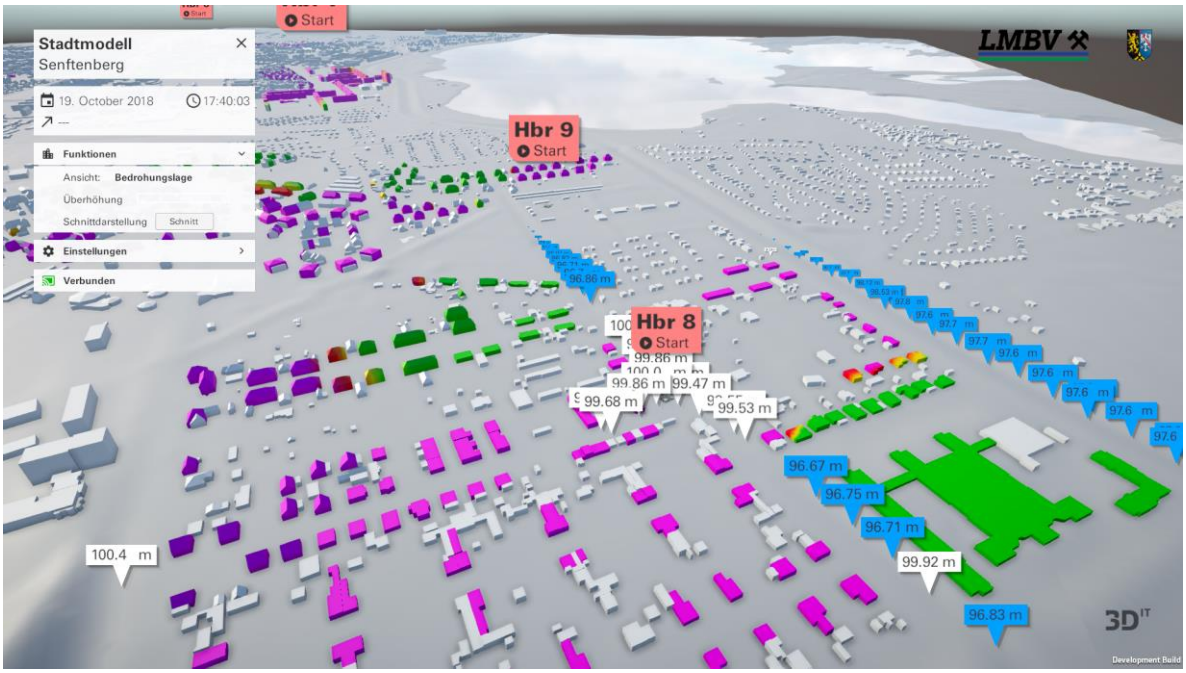

Figure 5 Digital terrain and city model plus integration of large-scale technical systems and sensors; query via OPC/UA interface in 3D real time; control possible; extrapolation of third variables (sectional views possible, also display of documents (digital twin). Courtesy of the project partners LMBV and UBV

(5) Conclusion

This increases the overall understanding of projects and the avoidance of errors. The coordination between different stakeholders is facilitated. Damage reports can also be recorded and processed in a simplified manner. Islands between existing solutions and information sources are cleverly connected without substituting the former.