

VIDENTE – What lies beneath?

A new approach of locating and identifying buried utility assets on site

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Abstract

This outdoor showcase features VIDENTE – an outdoor handheld solution enabling users to gain a glance at the underground infrastructure in their immediate environs. By combining mobile augmented reality (AR) and common wide area tracking technologies VIDENTE provides an enhanced vision of the road surface telling precisely where buried utility assets are situated beneath. The novel approach proposed by VIDENTE demonstrates how accurate underground city models embedded in a location aware context may contribute to successful accomplishment of common field tasks at utility and infrastructure companies. In order to provide an authentic experience of VIDENTE the showcase will employ real-world data retrieved from the operational geospatial database of the local power supplier Salzburg AG.

1 Topic of the showcase



Fig. 1: VIDENTE handheld augmented reality client platform

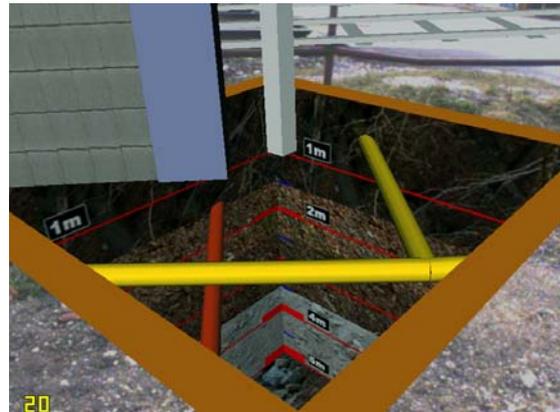


Fig. 2: Screenshot of a mobile augmented reality visualisation of underground utility assets (“virtual digging hole”)

This showcase will provide an insight into a novel approach of rapidly locating and identifying hidden underground utility network assets such as cables and pipes in the field. We will present VIDENTE – an outdoor handheld augmented reality system (Fig. 1), which has been developed over the past two years within the scope of a research cooperation of GRINTEC and TU Graz and is now available as a fully functional prototype.

VIDENTE is designed to assist field staff of utility and infrastructure companies in their everyday work tasks related to maintenance, outage management, asset record keeping and network planning. By means of augmented reality (AR) and advanced wide area tracking technologies such as GPS and inertial measurement systems VIDENTE provides users with an intuitive visualisation of the local underground infrastructure on a handheld device. That real-time visualisation is achieved by merging continuously streamed video footage of the user’s current environs

with geo-referenced 3D computer graphics derived from object geometries held in a geospatial database. Scenes rendered at the handheld device are updated in real-time according to the device's current position and orientation. Hence, depending on their current location, users obtain an integrated view of the real world environs enriched with synthetically presented information on the local subsurface infrastructure network. Unlike common approaches of locating hidden assets by means of paper maps or mobile GIS solutions VIDENTE conveys the underground network information directly in three dimensions employing an egocentric view. Users no longer have to transform map space into the real world. They simply see the hidden asset of interest as a virtual graphics overlay on the street surface in front of them. As a result of this more intuitive interface, likely error-prone map interpretations are avoided and on-site decision-making is notably facilitated.

By means of VIDENTE users are enabled to visualise both hidden underground objects such as cables, pipes and joins and abstract information such as legal boundaries or safety buffers. Corresponding semantic object data may be queried, as well. Buried assets projected at the office can be taken out to the field to be matched against the real world situation. VIDENTE's x-ray vision permits rapid perception of complex subsurface network layouts (Fig. 2).

Please refer to <http://www.vidente.at> for further details, imagery and video footage.

2 Technical details

VIDENTE is based on a multi-tier system architecture with a mobile frontend and a geospatial database as a backend. The handheld client runs the VIDENTE client application, which was built on top of *Studierstube*, a powerful framework for application development of mobile, collaborative and ubiquitous AR applications (<http://www.studierstube.org>). The VIDENTE client application takes care of merging geo-referenced 3D computer graphics, video footage and tracking information in real-time to provide graphically enriched visualisations of the current environs on the mobile client device.

The tracking of the handheld client is achieved by means of GPS enhanced with satellite-based correction data delivered by EGNOS. We are currently working on the integration of DGPS / RTK-GPS and intend to present that solution on the occasion of LBS 2008. The orientation tracking is covered by an inertial measurement unit.

Any data relevant for visualisation originates from a geospatial database based on GE Small-world (<http://www.gesmallworld.com>). Data is delivered to the client application in offline or online mode employing a lean GML3-based encoding for geospatial data exchange. The client application converts the delivered geospatial data into a corresponding three-dimensional computer graphics data structure, which is also capable of storing semantic object information.

3 Description of the showcase

The VIDENTE showcase will be carried out as an outdoor presentation comprising a concise theoretical introduction and a hands-on technology demonstration of the VIDENTE handheld augmented reality client setup. For the purpose of the showcase we will employ genuine underground utility network information kindly provided by local power supplier Salzburg AG (<http://www.salzburg-ag.at>). The underlying datasets are directly retrieved from Salzburg AG's operational environment geospatial database.

Attendees of the showcase will get a glance at a subset of Salzburg's underground city model (Fig. 3). Different types of subsurface utility features can be visualised, queried and even be

created. While moving around, attendees can view the underground city model from different perspectives. Attendees may experience themselves how their view at the real world can be enhanced with additional graphical information in real-time depending on their location.



Fig. 3: Screenshot of the VIDENTE client application showing real-world underground utility network information as retrieved from the operational GI system of Salzburg AG. Fig. 4: Alternative indoor showcase setup.

The outdoor showcase will be held at a spot within walking distance from the conference venue. Hence, no additional technical infrastructure is required. Considering the time of year the conference is held, we would prefer a slot, which guarantees daylight conditions for the outdoor demonstration. In case of poor weather conditions, we will provide an indoor presentation of our technology employing slides, pre-recorded video sequences and a table model for which we need a booth at the conference venue (Fig. 4). Depending on the number of participants we can schedule a showcase for about 0.5 – 1.0 h time.

Please refer to the sections “Demonstrations” and “Videos” at our project website at <http://www.vidente.at> to gain a better insight into the potential of our showcase.

4 Applying organisations

4.1 GRINTEC GmbH

GRINTEC is one of the leading enterprise software solution providers in Austria for geographical information systems and spatial databases. Being an authorised partner of General Electric Company since 1995 GRINTEC offers a full range of development and consulting services to utility companies and governmental organisations.

<http://www.grintec.com>

4.2 Institute of Computer Graphics and Vision (ICG), Graz University of Technology

ICG is the only Austrian academic group with the charter to address both Computer Vision and Computer Graphics, and is carefully nurturing a culture of Digital Visual Information Processing to resolve the artificial boundaries between computer graphics and computer vision. The research at ICG is focused on following topics: Computer Graphics, Medical Computer Vision, Object Recognition, Object Reconstruction, Robotics, Virtual Reality and Augmented Reality.

<http://www.icg.tugraz.at>