The Use of Augmented Reality, GPS and INS for Subsurface Data Visualisation

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ABSTRACT

Augmented Reality (AR) is a technology that allows information stored digitally to be overlaid graphically on views of the real world. A vast amount of such information currently resides in office-based computer systems but is not readily accessible to engineers and managers in the field.

This paper addresses research being undertaken for AR systems that will allow people to *look* into the ground and *see* underground features. These features could be major geological structures, gas or water pipe-work or zones of contaminated land. This ability to view underground features will revolutionise many elements of fieldwork for a wide range of industries involved with the natural and built environment.

Fundamental to the success of such a system is the ability to position the user with respect to the coordinate frame of the geographical database. Without position and orientation, overlaying the data for visualisation is impossible, if the solution is not accurate enough then registration errors will occur which will affect the usefulness of the system. The integration of kinematic GPS and INS allows centimetre level positioning and orientation to be achieved, opening up many applications using this tracker technology based in the field of personal navigation (Ladetto, 2000), (Judd, 1997). One such application researched at the University of Nottingham is the integration of this positioning technology with AR.

The University of Nottingham is directly involved in developing what is known in the field of Augmented Reality as the Tracker Technology. The aim is to develop a modular approach to the solution enabling different grades of achievable accuracy and creating a technology demonstrator effective in a real environment. In terms of the required accuracy, it is envisaged that the highest quality of position and orientation will be achieved through using RTK GPS combined with an IMU utilising gyroscopes, accelerometers and magnetometers.

The paper describes the research underway at the University of Nottingham concerning the integration of RTK GPS and an IMU to allow robust and precise real time positioning and orientation. This data is then used in the AR system to superimpose the virtual image onto the real-world view of the user.

The basic concepts of AR are explained with emphasis on the *tracking technology* required for an effective system. Additionally some applications are discussed considering the different requirements of the positioning and visualisation system.

This work brings together two state of the art technologies, RTK GPS and INS integration combined with Virtual Reality technology, through the collaboration of two research groups at the University of Nottingham.

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