Virtual Reality Mine Planning and Operation Control

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ABSTRACT:

3D-based visualizations and even Virtual/Augmented Reality applications are used in a variety of areas. For example, in special applications for architecture or the automotive industry, but also in web-based mass solutions for end users, such as in virtual room or kitchen planners. Due to today's availability of very powerful hardware, such applications can also be used by end users directly on a smartphone or tablet. However, in the mining industry, mostly very simple and schematic 3D visualizations have been used for several years. Here, the 3D model primarily serves as a navigation aid through the large data sets.

XGraphic GmbH has been developing individual software and technical systems with interactive graphical components for a wide range of applications for nearly 25 years now. The focus is on software applications for infrastructure and information management, planning tools, process monitoring and applications for mobile devices. As a rule, the presentation of data is always based on a suitable 3D model. Therefore, we are currently working on the development of a multifunctional and flexible software framework based on our many years of experience in this field. The tool provides interfaces and components for modular visualization solutions for use in raw materials industry and to implemented customer-specific applications. On top of that, virtual and augmented reality technologies could be integrated in order to offer further added value.

The visualization cockpit developed in the context of the Real-Time Mining project is an interactive 3D application with different screens for the clear representation of the data resulting from the sensor-based monitoring processes as well as the calculated potentials for process optimization based on the 3D mine geometry.

The modules include the visualization of the deposit-model, 3D extraction planning, integrated data of the positioning-system as well as the visualization of sensor and machine performance data. Different tools will have been developed for supporting operation control and optimized decision making based on real-time data from the centralized database.

The visualization cockpit is divided into two levels: The planning views offers various screens in which the information relevant for short-term planning and process optimization is displayed. In the operation views, current positions of mobile units and various sensor data are displayed georeferenced on the 3D model.

The main screen of the cockpit is based on an interactive 3D representation of the mine layout. The user can rotate, move and zoom in/out the model to create individual views. Based on this representation, all active operating points are displayed with the corresponding basic information on mineral content, tonnage and information on the mining plan. By selecting an operating point, a detailed view of the working face can be displayed with graphical information on the relevant deposits, the so-called Face View. This shows the local Grade Control Model (short-term model with block contents and properties of the ore) for optimizing the drilling schemes and enables access to current data from material recognition (photos, classifications, ...).

The implementation is carried out based on the latest technologies with respect to special software development requirements such as user-friendliness, performance, compatibility, modularity and expandability. Within the scope of development, the expertise of the partners involved in the implementation of graphical applications and process monitoring systems for use in underground mining will be drawn upon. Beyond that, new hardware technologies offer a variety of possibilities for innovative extensions of the visualization cockpit. The use of virtual reality hardware enables immersive exploration of the 3D data. In this way, the relevant decision-making processes can be made even more intuitive.

The realization of Virtual Reality applications is nowadays already possible with commercially available computer hardware. All you need are suitable screens, a powerful graphics card and shutter glasses. In addition to VR display on screens, visualization via VR headsets is another possibility. Such a headset is put on by a user and offers an even more immersive experience than conventional VR applications due to its isolation from the environment. A VR headset consists of an integrated solution for displaying a 3D image adapted to the respective eye and tracking the position and alignment of the VR headset.

New hardware technologies offer a variety of possibilities for innovative implementation of visualization solutions. The use of virtual reality glasses enables immersive exploration of the 3D data. This is even more intuitive and convenient than a “classic” 3D visualization and offer great opportunities to support optimized decision making.