Mining Geomatics

Subjects: Mining & Mineral Processing

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Mining geomatics is the knowledge and ability of using information systems to integrate and process spatial data about objects and phenomena occurring in the mining space in a way that enables the modelling and design of mining activities together with monitoring and visualising their state, analysing their changes and forecasting the effects of mining operations.

mining geomatics spatial data GIS GMP MiningGIS mining

1. Introduction

An analysis of the history of GIS software changes linked to the history of GMPs software changes made it possible to estimate the direction of change of data structures and spatial data exchange methods in these technologies. An analysis of attempts to create and popularise acronyms related to the use of GIS acronyms in mining and an associative analysis of the occurrence of selected mining and geomatics terms in the scientific literature made it possible to define an area of knowledge and skills in spatial data processing in mining.

2. Proposed Definition of the Term "Mining Geomatics"

The new definition of geomatics [1] does not refer to norms and standards, nor does it force geomatics to extinguish or replace other scientific disciplines. It is oriented towards data integration rather than data acquisition. Geomatics is the analysis of spatial data to discover knowledge about the spatial relationships of objects and phenomena related to the Earth's surface. Therefore, the first building block of the new definition will be the term geomatics.

Theorem

Mining geomatics is the knowledge and ability of using information systems to integrate and process spatial data about objects and phenomena occurring in the mining space in a way that enables the modelling and design of mining activities together with monitoring and visualising their state, analysing their changes and forecasting the effects of mining operations.

The defined new concept should not be considered as a science or a scientific discipline. In a scientific context, the concept can and should be classified as a "community of practice" in the field of science, combining only mining science and spatial data processing systems informatics. The next step after formulating the definition is to define its scope and research area.

3. Preliminary Proposal for the Scope of the Body of Knowledge for Mining Geomatics

One of the key factors determining the functioning and development of a professional community around an idea or concept is a set of basic principles and concepts, identifying the problems and processing methods used within that group. It is therefore important to identify and define an initial form of Body of Knowledge (BoK) for mining geomatics. It is therefore necessary to identify the knowledge and abilities that characterise the conceptual scope and problems associated with the operation of spatial data processing systems in mining operations.

3.1. Single Geodetic Coordinate System at the Mine Site

In the past, it was common practice for newly constructed mining operations to establish their own local coordinate systems. This was for a number of reasons: from facilitating geodetic calculations by means of a reduced number of digits in the numbers used to describe coordinates to making the definition of a unique coordinate system secret in order to protect information about a country's strategic resources. An additional factor hindering the use of mining maps was the frequent practice of using several different coordinate systems even within a single mine.

3.2. Management of Spatial Data Acquisition

Mining geomatics is primarily concerned with the integration of data based on spatial data acquired in the various technical departments of a mining site for reuse. These data form the basis for integrating the other mining data—geology, hydrogeology, seismic, mining design ventilation and others—into a single model (one data schema) that can be processed aggregated and supplemented with data from other sources.

3.3. Three-Dimensional Modelling of Mining Data

A typical two-dimensional data presentation in the form of a mine workings map is mostly a well-standardised cartographic product used by all technical departments of a mine. In the field of three-dimensional mine workings cartography, there is no such standardisation anymore. GMP software providers equip the user with their own 3D working technologies binding the user to their products. There is a need to develop a vendor-independent, three-dimensional mine data model as the sole source of data for mine processing systems, including consideration of changes over time.

3.4. Management of Data Processing Systems

The management of spatial data in a mining site has several aspects which can be divided into the following issues: 1) methods of integrating spatial data using different types of data processing technologies (SDI, ETL, and SpatialDB), 2) the problem of separating spatial data from their processing systems to avoid data locking - "VendorLock", 3) standardisation of spatial data using different technologies and different formats including object name dictionaries.

3.5. Big Data in Mining

In the field of geomatics, there is the problem of performing spatial analyses of large amounts of data. In mineral mining, the problem of large amounts of data requiring processing is also apparent. One of the earliest publications demonstrating the use of Big Data technology in mining concerned the use of this technology to analyse geological data in order to improve and refine mineral deposit models for mining companies.

3.6. Augmented Reality and Virtual Reality

Augmented reality (abbreviated AR) is a visualisation system that combines an image of a fragment of the real world viewed by the user at a given time with a superimposed digital representation of that world, computer generated from a pre-prepared digital spatial model of the image of that real world (...). Virtual reality (VR) depicts the real world on a computer. It is a technology aimed at mapping the real world and visualising it for the user in a way that is as close as possible to the actual perception of the outside world—the visualised part of reality. With this technology, a miner can view a mining pit in the safety of an office.

3.7. Data Exchange and Collaboration with the Social, Administrative and Economic Environment

The primary form of data exchange is the import and export of spatial data files. Geoinformatics technologies allow for data sharing, which can facilitate and automate access to data. In this regard, data exchange refers to the capacity of the mining company's internal systems, which should be prepared to exchange data with the company's customers, external systems of state and government entities and with external cooperators.

3.8. Mining Geomatics Engineer as a New Profession

Mining geomatics can be the basis for defining a new type of profession within the mining industry that combines basic mining and geological knowledge with geo-informatics skills to maximise the use of hardware and software to effectively manage mining operations processes.

The outlined scope of BoK is an introductory - an initial set of concepts describing the concept of mining geomatics but gives a good approximation of its scope at an initial stage.

The definition of mining geomatics was formulated in a scientific article published in the journal IJGI [2] and from there it was included in the encyclopedia.

References

1. Artur Krawczyk; Proposal of Redefinition of the Terms Geomatics and Geoinformatics on the Basis of Terminological Postulates. *ISPRS Int. J. Geo-Information* **2022**, *11*, 557.

2. Krawczyk A. Mining Geomatics. *IJGI* **2023**, *12(7)*, 278.

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