

illuMINEation

AMBITIOUS EC FUNDED RESEARCH PROJECT IMPROVES HEALTH, SAFETY AND ENVIRONMENTAL PERFORMANCE IN THE MINING SECTOR

Europe's valuable mineral deposits can only be exploited, if the very strict legal and environmental requirements are met and the local communities do not perceive mining operations as a risk to their livelihood, rather as a source of work, income and prosperity.

For this very reason, health, safety and environmental (HS&E) standards and performance are considered the most important core values applicable to the mining industry sector. The implementation of technologies ensuring highest possible performance levels of those aforementioned values require the combination of many cutting-edge approaches, disciplines and collaboration of European experts from various different fields of expertise. The *illuMINEation* consortium recently met in Leoben, Austria, to discuss the progress of the research and innovation project and the important results achieved since the start of the project.

Combining data to minimize risks

The *illuMINEation* project uses various sensing technologies comprising off-the-shelf low-cost sensors combined with sensors serving specific needs for integration into a digital mine management system. Valuable information acquired by extensive sensor networks are subsequently processed and analysed via sophisticated data analytics including machine learning algorithms in order to:

- a. support a comprehensive and real-time HS&E, risk and sustainability assessment;
- b. provide a cost-effective way of ensuring that high HS&E standards are kept;
- c. ensure, in the long run, sustainable and economically efficient extraction of raw minerals that are crucially needed by Europe's industry sectors; and to
- d. facilitate a more transparent mining industry so that public acceptance, awareness and trust in mining activities can be increased.

The project is centred around the development of a reliable, large-scale data-intensive and highly adaptable digital Industrial Internet of Things platform, capable of processing data for various mining-related applications. Technologies deployed and investigated that are linked to the safe zone classification are:

- "Intelligent Rock Bolts" combine classical rock support methods with novel low-cost sensor solutions for rock mass stability monitoring, as well as sensors that continuously monitor atmospheric conditions in underground environment.
- Deployment of autonomous drones under harsh underground mining conditions is a major challenge. Use of appropriate sensor suites provide accurate navigation and collision-free performance in GPS-denied environment whilst at the same minimizes the drone's weight and maximizes flight-time.
- Big data analytics of combined seismic, hydrological, geological and structural sensor data of large-scale tailings dams monitoring networks will help to prevent potential dam failure accidents.
- Sensor-based monitoring systems for mining machinery using various data loggers mounted on machines include early warning systems in order to avoid collisions between equipment and underground personnel.

All real-time information on workplace conditions is directly made available to mining personnel via digital interfaces such as dashboards on tablets and mobile phones, or via augmented / virtual reality devices.

According to the World Economic Forum, the use of digital mining technologies – as envisaged in the *illuMINEation* project – has the potential to save about 1,000 lives and prevent 44,000 accidents over the next 10 years¹.

¹ World Economic Forum: "Mining and Metals: digital transformation and the industry's 'new normal'"

(<http://reports.weforum.org/digital-transformation/mining-and-metals-digital-transformation-and-the-industrys-new-normal/>)

First successful installation tests of the “Intelligent Rock Bolts”

Project partners have already conducted the first-time installation of sensor bolt heads developed in the course of the *illuMINEation* project. The intelligent rock bolt heads consist of various sensors, a microprocessor, a rechargeable battery, and a device for data transmission. This low-cost intelligent rock bolt assembly allows near-real-time recording and visualization of geotechnical and environmental measurands on a large-scale basis – a milestone towards underground digitalisation and safety.

Project partners

The high quality and multidisciplinary project consortium consists of 19 partners from six European countries (AT, SE, PL, DE, ES, FI), constituting a well-balanced assembly of world leading industrial and academic players from a multitude of technical fields and applications: Montanuniversitaet Leoben (AT; coordinator), Joanneum Research Forschungsgesellschaft MBH (AT), Epiroc Rock Drills AB (SE), ams AG (AT), KGHM Cuprum sp. z o.o. (PL), DMT GmbH & CO. KG (DE), GEOTEKO Serwis Sp. z o.o. (PL), Lulea Tekniska University (SE), Universidad Politécnica de Madrid (ES), KGHM Polska Miedz SA (PL), Minera de Orgiva SL (ES), RHI Magnesita GmbH (AT), DSI Underground Austria GmbH (AT), Retenua AB (SE), IMA Engineering Ltd Oy (FI), Fundacion Tecnalia Research & Innovation (ES), Worldsensing SL (ES), Instytut Chemii Bioorganicznej Polskiej Akademii Nauk (PL), Boliden Mineral AB (SE).

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