illuMINEation
THE FUTURE OF MINING

NEWSLETTER

ISSUE 5 | September 2023

The *illuMINEation* project started in September 2020 and is a 3 ½ - year project funded by the European Commission. Nineteen partners are collaborating in order to develop bright concepts for a safe and sustainable digital mining future. With this newsletter, the interdisciplinary *illuMINEation* consortium provides a short summary of important recent project activities.

ARTIFICIAL INTELLIGENCE IN MINING

TAILINGS DAM STABILITY MONITORING VIA MACHINE LEARNING APPROACHES

Tailings storage facilities (TSFs) require comprehensive engineering solutions to effectively mitigate potential risks. As part of illuMINEation, a specialized engineering framework tailored to analyse and interpret data from TSFs, with a specific focus on its successful application at the Zelazny Most TSF (KGHM Poland), has been developed. By harnessing advanced data analysis techniques and leveraging machine learning algorithms, this framework enables engineers to accurately assess critical parameters, including displacement, pore water pressure, geotechnical layers, and factor of safety.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869379.

The demonstrated capabilities of this specialized engineering solution highlight its pivotal role in proactive monitoring and evaluating the safety status of TSFs. Through in-depth data analysis and interpretation, engineers can detect potential instabilities, identify areas of concern, and prioritize targeted risk mitigation strategies. By implementing this framework, engineering professionals can enhance the safety and stability of TSFs, safeguarding not only the surrounding environment but also the well-being of nearby communities.

The successful application of this specialized engineering solution at the Zelazny Most TSF proves its effectiveness in providing critical insights and enabling informed decision-making. By employing cutting-edge technologies and methodologies, engineers can proactively address potential risks, reduce the likelihood of accidents or failures, and uphold the integrity of TSFs. The project results underscore the significant contribution of data analysis and machine learning approaches in ensuring the long-term sustainability and safety of TSFs worldwide.

Use Case testing

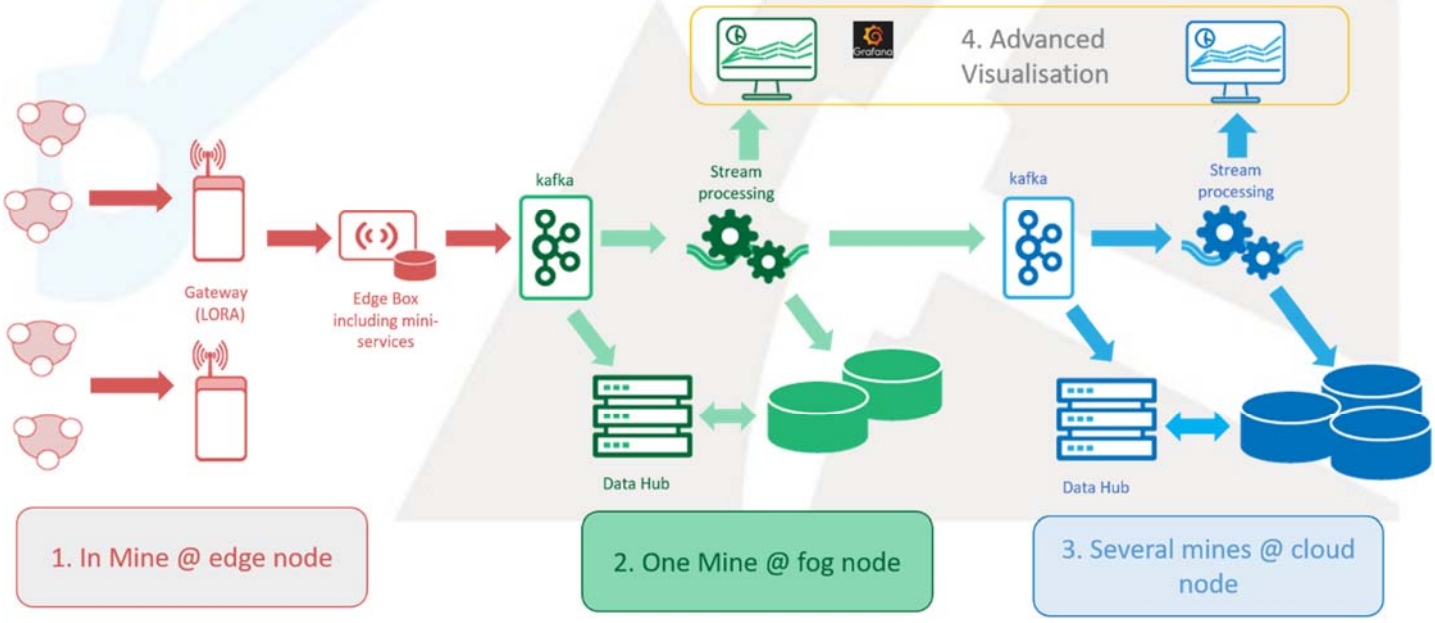
The illuMINEation project partners KGHM Polska Miedź S.A. and Geoteko performed various tests of the abovementioned Artificial Intelligence system at the Zelazny Most Tailings Storage Facility. The AI system will help engineers to manage and analyse data acquired by extensive sensor networks that continuously monitor the tailings dam. The AI performs numerical multivariant stability calculations taking into account the influence of different factors and scenarios.

illuMINEation IIoT platform

The Edge Node

The Industrial Internet of Things (IIoT) platform connects the physical mining with the appropriate computing structures that are provided within the Edge-Fog-Cloud continuum including distributed data management. In order to ensure the platform is as highly flexible and easily manageable, all parts of the Edge-Fog-Cloud use a container-based approach. It can be adapted to different use cases in mining operations.

Data from sensors such as rock bolts, temperature, humidity, CO_2, etc. is collected in the so-called Edge box. The sensors send the data to the analytics box at the Edge of the mine via a wireless sensor network such as e.g. LoRa, where data is processed, information clustered and appropriately forwarded to higher layers. In this way, the solution becomes more robust and only the data that is really needed and required is sent onwards to the fog and cloud layers.



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From a technical point of view, the Edge analytics box uses Docker containers for the management of the different parts of the application. This makes it easy to update the programme. Currently, the platform developers are working on using and adopting the platform for different illuMINEation-related use case scenarios.

INNOVATIVE DRONE LANDING STATION USE CASE TESTING

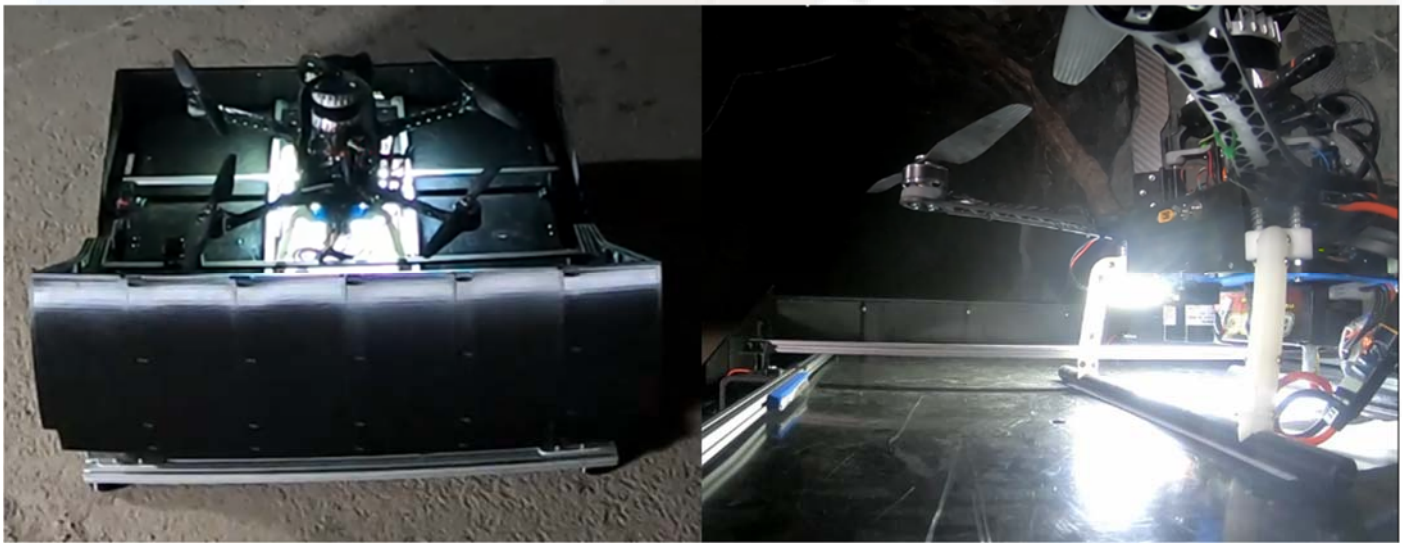
A drone landing station that can be embedded in mining infrastructure allowing to rapidly launch autonomous inspection missions with drones was developed by the Robotics team of the illuMINEation project partner LTU. Tunnel inspection missions within an underground test mine facility where the capsule interfaces with the drone to launch the mission were successfully completed.

ILLUMINEATION PROJECT LECTURE XXIII SIMPOSIUM DE INGENIERÍA EN MINAS

The illuMINEation project lecture "Bright concepts for a safe & sustainable digital mining future" as part of the XXIII Simposium de Ingeniería en Minas - SIMIN 2023 de la Universidad de Santiago de Chile was held as a webinar on June 1st.

Presentations were given by experts from the illuMINEation project team: Begoña Ispizua Moreno, Tecnalia Research & Innovation; Alberto Jimenez Cortadi, Tecnalia Research & Innovation; Ignasi Garcia-Milà Vidal, Worldsensing and Alberto Fernandez, Universidad Politécnica de Madrid.

The topics addressed the future of sustainable mining through the study of predictive maintenance, advanced drilling technologies (so-called "Measurement-while-Drilling"), integration of sensors and Internet of Things tools and their applications in the mining environment.



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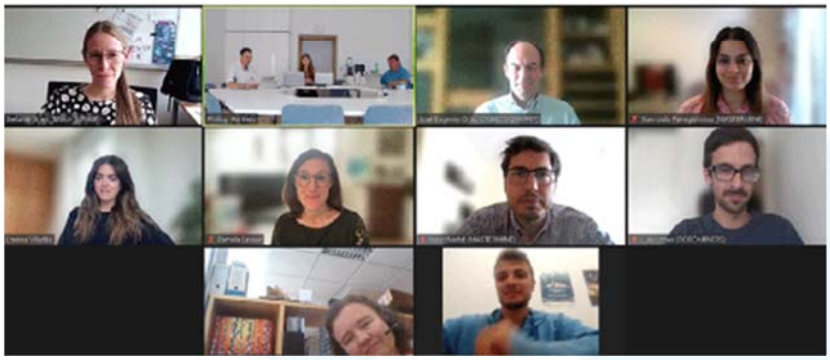

THE 8 SISTER PROJECTS

CLUSTERING MEETING

In May, project representatives from 8 mining-related projects, i.e. illuMINEation, ROBOMINERS, Digi-EcoQuarry, SUMEX, Sea4Value, Dig_IT, Rotate and MASTERMINE, gathered in an online clustering meeting in order to discuss challenges, lessons learned and joint activities. It was a very fruitful exchange – many thanks again to all participants of the projects for sharing their experiences.

6TH CONSORTIUM MEETING

GARPENBERG & ÖREBRO, SWEDEN

In mid-June, the project team members met for the 6th illuMINEation consortium meeting, kindly co-organised and hosted by our colleagues from Boliden at the beautiful Garpenberg Castle and Epiroc's production facility in Örebro, both located in Sweden.

On the first meeting day, the project partners presented their main achievements and major results as well as the preliminary outcome of the deployment, testing and utilisation of the project developments. Another timeslot was dedicated to a workshop focussing on dissemination & exploitation. During the following two days, the participants had the fantastic opportunity to visit the production facilities of the project partners Boliden and Epiroc. First, the team

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visited the-state-of-the-art underground mining operation and mineral processing facility of Boliden's Garpenberg mine, and on the next day, all participants had the chance to see where and how Epiroc mining and tunnelling machines are manufactured.

Our next 7th and final consortium meeting will be held in Poland in early 2024.

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Editorial

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Check out our project website and follow us on LinkedIn and Twitter to find out the latest news and stories from the project!

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