1ST Newsletter of NETHELIX

Welcome to the first newsletter of NETHELIX

Dear Readers,

The consortium of **NETHELIX (Intelligent digital toolbox towards more sustainable and safer extraction of mineral resources)** is pleased to welcome you to the project's **first newsletter**. NETHELIX project focuses on **enhancing the efficiency of mineral extraction processes, improving the workers' safety, and reducing environmental impacts**. The project considers developing and integrating various advanced technologies, including eco-friendly machinery, precision drilling systems, autonomous mining equipment, smart sensors, as well as Artificial Intelligence (AI) and data analytics-based predictive maintenance tools.

Through the current and upcoming newsletters, NETHELIX consortium will keep you informed on how the project is progressing and share with you its main achievements. This first issue of the newsletter is intended to provide you with some research activities and key results from the start of the project so far.

Stepping on the end-user requirements and the considered use cases, NETHELIX team has worked effectively through the technical work packages of the project, reaching a major milestone in toolkit development with regards to the component prototypes. The work on validation and pre-pilot testing in real mining environment has also progressed, paving way for the upcoming pilot demonstration activities.

In parallel, communication channels (in the form of Project Website and Social Media accounts) have been established, and collaboration with other EU-funded projects/initiatives has been solidified. The NETHELIX consortium partners have also participated in various conferences and events to promote awareness about the project and directly connect with stakeholders and public at large.

In the forthcoming period and until the end of its timespan, NETHELIX will continue its focused work reflecting its growing momentum and commitment to **shaping the future of the raw materials sector**.

We wish you a pleasant read,

NETHELIX Consortium

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NETHELIX Showcased at Prospectors & Developers Association of Canada (PDAC) 2023 Convention in Toronto, Canada

The NETHELIX project was prominently featured at the prestigious **PDAC 2023 Convention**, held in **Toronto, Canada**, from **March 5–8, 2023**. Representing the **Technische Universität Bergakademie Freiberg (TUBAF)**, researcher **Ali Erdesat** delivered a comprehensive presentation on NETHELIX as part of the **European Commission's delegation**. As the world's premier mineral exploration and mining convention, PDAC gathered over **30,000 attendees from 135+ countries**, providing NETHELIX with a valuable platform for international exposure, stakeholder engagement, and collaboration opportunities.

First Project Plenary Meeting in Thessaloniki, Greece

The NETHELIX consortium held its **1st Plenary Meeting** on **June 20–22, 2023**, in **Thessaloniki, Greece**, bringing together all project partners for a productive three-day session. Partners engaged in discussions to identify and refine the **project's core use cases** and **technical objectives**, ensuring all needs and expectations are well understood. Each **work package (WP)** was also reviewed in detail, to confirm the involved partner responsibilities and define the implementation methodology. The meeting marked a significant milestone in aligning NETHELIX's direction, and setting a collaborative framework for the next phase of project activities.

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NETHELIX Joins the "Smart Ecomine Hub" Cluster

Strategic collaboration is key to NETHELIX's mission to amplify its visibility and impact within the mining innovation ecosystem. In this spirit, NETHELIX has joined the **Smart Ecomine Hub**, a collaborative cluster that encourages synergies among projects and stakeholders. By connecting with other EU-funded initiatives such as **DINAMINE**, **MASTERMINE**, and **Mine.io**, NETHELIX is fostering cross-project dialogue, sharing knowledge, and contributing to the development of forward-thinking, sustainable mining solutions.

NETHELIX Papers Published

NETHELIX partners, **Cyprus Research & Innovation Center Ltd. (CyRIC)** and **KGHM Cuprum Research and Development Centre Ltd.**, published **papers** in the context of their project-related work. In particular, as a result of CyRIC's presentation in the IEEE Sensors 2023 Conference (October 29 – November 01, 2023, in Vienna, Austria), a paper on low-cost fully integrated smart insole system was included in the published conference proceedings. The paper points out the great potential of smart insoles in real-time monitoring, analysis, and feedback for foot biomechanics, aiding in injury prevention and performance improvement. On the other hand, KGHM published a journal paper on intelligent decision support system for ore transportation in underground mine. The paper introduces a solution to the problem related to difficulties in the management and use of the complex and heterogeneous mine transportation networks.

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Conferences > 2023 IEEE SENSORS

A Cost Effective Smart Insole System for Real Time Gait Analysis

Publisher: IEEE Cite This PDF

Nikos Antoniou ; Antonis Hadjiantonis ; Costas Kyriacou ; Andreas Konstantinidis **All Authors**

Abstract:
Smart insoles have great potential as they offer real-time monitoring, analysis, and feedback for foot biomechanics, aiding in injury prevention and athletic performance improvement. Although off-the-shelf smart insoles exists, and solutions have been proposed, they are either very expensive, non-integrable, or lack sensors. In the current work, a lowcost fully integrated smart insole is introduced. The design integrates Force Sensing Resistors (FSRs), a 9-DOF IMU, Bluetooth Low Energy (BLE), and wireless charging. The system can transmit in real-time at 100Hz for more than 6 hours with a 40 mAh battery. It can accurately identify walking and running patterns with great synchronization between the left and right foot.

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Date Added to IEEE *Xplore*: 28 November 2023
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Conference Location: Vienna, Austria

Procedia Computer Science
Volume 225, 2023, Pages 922-931

The Concept of an Intelligent Decision Support System for Ore Transportation in Underground Mine

Artur Skoczylas [a b] ✉, Paweł Stefaniak [a], Wiesława Gryncewicz [b], Artur Rot [b]

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https://doi.org/10.1016/j.procs.2023.10.079

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Second Project Plenary Meeting in Villach, Austria

The NETHELIX consortium convened for its **2nd Plenary Meeting** in **Villach, Austria**, from **January 31 – February 1, 2024**. The two-day event provided a valuable opportunity for partners to report **progress and achievements**, address **challenges**, and align on **next steps**. The meeting strengthened collaboration among consortium members and confirmed their commitment to achieving project goals effectively and on schedule.

NETHELIX Featured at BEYOND 2024 Expo in Greece

From **April 25–27, 2024**, NETHELIX took part in the **BEYOND 2024 Expo**, a leading Southeast European exhibition for technology and innovation, held in **Thessaloniki, Greece**. The project was represented by **Satways Ltd.**, the Coordinator, through a dedicated exhibition booth showcasing NETHELIX's vision and technological solutions. Engaging discussions with visitors highlighted the project's contributions to **smart, ecological, and sustainable mining practices** through its cutting-edge technologies.

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Successful First Project Review Meeting in Athens, Greece

The **first NETHELIX Project Review Meeting** took place on **September 25, 2024**, in **Athens, Greece**, where the consortium presented progress updates to the **EU Project Officer and external reviewer**. The meeting was productive and well-received, with the EU representatives offering **constructive feedback** and expressing strong support for the project's trajectory and achievements.

Third Project Plenary Meeting in Athens, Greece

On **September 26, 2024**, the NETHELIX consortium convened for its **3rd Plenary Meeting** in **Athens, Greece**. Consortium partners had the opportunity to discuss the progress achieved so far, and plan for the subsequent **pre-pilot testing** activities of the developed technological **prototypes** within the upcoming implementation period. This phase is expected to provide an essential opportunity to evaluate and refine the solutions, ensuring that the technologies are robust and ready for full-scale implementation. The meeting not only emphasized the technical progress of NETHELIX but also strengthened the cooperation between the consortium partners, ensuring that the collective expertise continues to guide the project toward achieving its objectives.

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Participation in the 9th Greek Raw Materials Community Dialogue

On **November 20, 2024**, NETHELIX joined the **9th Greek Raw Materials Community Dialogue** in **Athens, Greece**, which this year centered around the **Critical Raw Materials Act**. The event was attended by policymakers, industry professionals, and innovators to discuss sustainable development within the raw materials sector. During the poster session, **Satways Ltd.** presented NETHELIX's core system architecture and technological components. Project's representatives engaged with over 30 researchers and industry experts during the event, providing them with an in-depth look at how NETHELIX is advancing technological innovation in the mining sector, with a strong focus on sustainability and resilience.

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Fourth Plenary Meeting Held in Tampere, Finland

The **4th NETHELIX Plenary Meeting** was hosted by our partner **SANDVIK** in **Tampere, Finland**, on **March 12–13, 2025**. Consortium members discussed project advancements and outlined plans for the upcoming **pre-pilot testing activities**, scheduled at **FLB (Germany)** and **SANDVIK (Finland)** mine sites. These tests will focus on integrating NETHELIX components into real-world mining environments.

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NETHELIX Returns to BEYOND 2025 Expo (Smart Insoles)

At **BEYOND 2025**, held from **April 4–6, 2025**, in **Athens**, NETHELIX was again prominently showcased. **Satways Ltd.** presented the project's technological innovations through an eye-catching poster display, while **CyRIC (Cyprus Research & Innovation Center Ltd.)** demonstrated the **Smart Insoles**—a novel wearable solution designed to enhance **worker safety and performance** in mine operational environment through embedded sensors that monitor foot activity (e.g., walking, stair ascending/descending, etc.) and provide alerts for several events (e.g., unconscious, injured or over-tired users). The dual presence exemplified NETHELIX's commitment to deploying practical, forward-looking tools in mining operations.

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The development of the **smart insole prototype** introduced t**wo main novel design and technological elements** that significantly advance the state-of-the-art in wearable safety systems for industrial and underground environments:

- **Indoor Localization**: instead of traditional tags or smartphones, a unique multi-stage filtering-based method is used, making it a new and practical solution for places where GPS doesn't work, like underground environments.
- **Fatigue Index Estimation Algorithm**, using only motion and pressure data (not vital sign measurements such as heart rate or oxygen saturation).

Pre-Pilot Testing at FLB Mine Site, Germany

From **May 14–23, 2025**, **TUBAF** organized a **pre-pilot testing campaign** at the **FLB mine site** in Germany. The trials focused on validating NETHELIX's advanced digital solutions in both underground and surface environments, under real-world conditions such as heat, humidity, and vibration. Key technologies tested included:

- Laser-based air quality analyzers
- Energy monitoring and predictive maintenance systems
- Smart insoles for worker health monitoring
- Augmented Reality (AR) for situational awareness
- Operational risk assessment tools
- Middleware for system integration
- Physical Security Information Management (PSIM) systems

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Key Performance Indicators (KPIs) were tracked throughout to ensure alignment with project objectives and to inform further optimization ahead of full-scale pilots.

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NETHELIX Showcased Innovation at CSI 2025 Conference in Germany

NETHELIX was actively represented at **CSI 2025 Conference** held from **July 27–31** in **Ulm, Germany**, through its cutting-edge developments in **air quality monitoring for mining environments**. Representing the **University of Ulm (UULM)**, **Dr. Lisa Walter** delivered a comprehensive presentation on **mid-infrared laser-based air quality analyzers** in mining scenarios – a joint research effort between the NETHELIX partners, UULM and **ALPES LASERS SA**. The presentation sparked interest in the growing potential of laser technology to enhance air quality control in challenging settings like mines. In addition, a relevant research poster was showcased, further highlighting the strong collaboration between UULM and ALPES in pushing the boundaries of environmental sensing. Visitors to the conference were also welcomed at the NETHELIX stand, where a live demonstration of the developed **gas sensor** attracted the attention from researchers and industry stakeholders alike.

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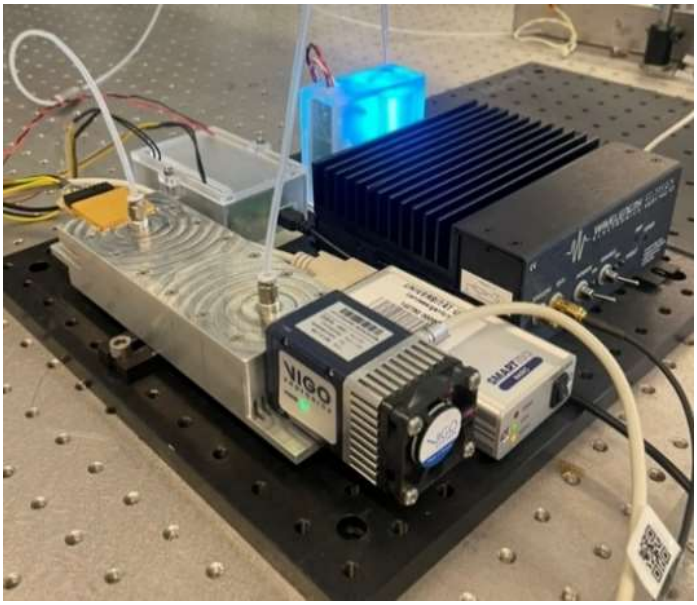
Toolkit Development Reaches Major Milestone

NETHELIX has successfully completed the **alpha version** of its innovative toolkit—a major leap toward safer, smarter, and more sustainable mining. Most components have passed initial lab testing, and refinement is now underway based on feedback from **pre-pilot trials**. These evaluations, guided by strict performance metrics, are paving the way for the upcoming **beta release**, to be fully demonstrated during the **2026 pilot deployments**. This robust validation process ensures all tools meet the **quality and functionality standards** defined as part of early project phases.



Laser-based air-quality analyzer (also simply called **"gas sensor"**, developed by University of Ulm and ALPES Lasers SA), for detecting harmful and dangerous gaseous (O_2, CO, CO_2, CH_4, NO, NO_2, SO_2 and H_2S) molecules at concentration below critical limits in mining areas.

Augmented Reality (AR) device (Magic Leap 2 headset) which an **AR application** was developed for (by Satways Ltd.), to provide situational awareness and training on mine machinery by overlaying 3D digital content onto real-world environment.

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Inertial Measurement Unit (IMU) used by KGHM Cuprum for collecting data in underground mine

Smart insoles (developed by Cyprus Research & Innovation Center Ltd. – CyRIC) enhancing the health and safety of users in mine operational environment through embedded sensors that monitor foot activity (e.g., walking, stair ascending/descending, etc.) and provide alerts for several events (e.g., unconscious, injured or over-tired users).

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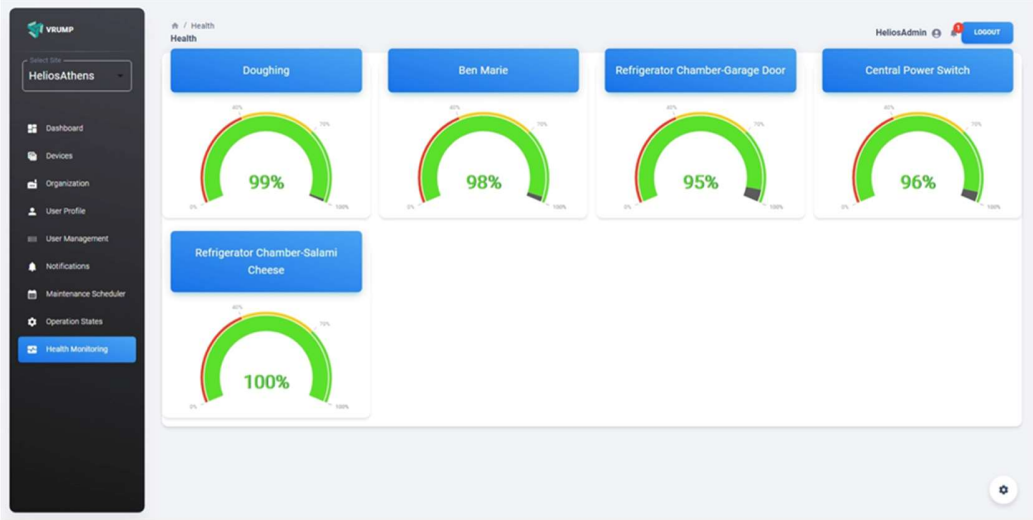

Software component of **Energy Monitoring tool** (developed by VRUMP) for predictive maintenance through early fault detection, based on the collection of mine machinery health and energy efficiency data.

Physical Security Information Management (PSIM) platform (developed by ASTRIAL Gmbh) for monitoring, visualising and managing operational, safety, and security information across mining environments.

Stay tuned for more NETHELIX updates as we continue our journey towards revolutionizing the mining sector through **innovation, sustainability, and safety**.

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