

INFINITUS

The total asset safety solution integrating metasensing, monitoring, and visualization for Mining Projects.

DATA COLLECTION

- Remote Sensing: InSAR, Optical, Thermal Imagery, Multispectral and Hyperspectral Imagery
- Surveying and 3D Modeling: UAVs, LiDAR, Laser Scanning, Radar, Total Stations, GNSS
- Surface and Sub-surface Sensors: Fiber Optics Sensors, Environmental & Geotechnical Instrumentation
- NexaWave IoT Dataloggers

DATA INTEGRATION

- Cross-platform seamless data integration across diverse sources from sensors to surveying to satellite data.
- Dynamic data visualisation
- AI & Machine Learning integration

DATA ANALYSIS & UNDERSTANDING

- Data Reporting
- Data Visualization
- GIS integration
- Digital Twins
- Data Validation

RISK ASSESSMENT AND ALARM MANAGEMENT SYSTEM

- Proqio's Early Warning System
- Integration with Government Risk Assessment Systems
- Control, Safety, Flexibility

CONTINUOUS MONITORING

- Predictive Intelligence
- Advanced Visualization
- Automatic Reporting
- Customizable Dashboards



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DATA COLLECTION

This step involves extensive data collection using specialized measurement technologies adapted to mines and tailing dams' unique needs. These technologies are crucial for capturing detailed images, scientific parameters, and topographical data, essential for accurate monitoring, safety, and operational efficiency in mining environments.

Measurement Technologies:

- Remote, Surface, or Sub-Surface Data Collection: Tailored to mines and tailings dams' specific geological and structural characteristics.

Methods of Data Collection:

- **Historical Data Collection:** Utilizing satellite data and site investigations to analyze past geological changes and structural integrity of mining areas and tailing dams.
- **Real-Time Data Collection:** Employ sensors and surveying tools specifically designed for mining operations and tailings dam monitoring.

Key Technologies Employed:

- **Satellites and Aerial Vehicles:** Equipped with specialized sensors like LiDAR, radar, and optical cameras for high-resolution imaging for monitoring mineral content, structural changes, and potential risks in and around the mine and tailing dams.
- **Sensors:** Include geotechnical sensors, environmental sensors, and fiber optics, now specifically calibrated for mining-related parameters like vibration levels, slope stability, and tailings dam integrity.
- **Survey Equipment:** Tools adapted for the rugged and varied terrain of mining areas, including tailings dams.

Remote Sensing Techniques:

- **InSAR and DInSAR:** For mapping ground deformation focusing on areas around mines and tailings dams.
- **Optical and Thermal Imagery:** For monitoring changes in land cover, detecting heat anomalies, and assessing soil moisture levels in mining areas.
- **Radar Data:** Tailored for mining environments to measure surface deformation, especially around tailings dams.
- **Multispectral and Hyperspectral Imagery:** Adapted to identify mineralogical changes and environmental impacts caused by mining activities.

Advanced Surveying and 3D Modelling:

- **UAV Surveying:** For high-resolution data collection and processing. HD/ IR/ Thermal Cameras can also be applied to UAVs.
- **LiDAR, Scanner, and Radar Surveying:** Providing detailed topographical and environmental data crucial for mine and tailing dam safety.
- **Automatic Total Station and GNSS/GPS Monitoring:** For precise location tracking and movement analysis.

Comprehensive Instrumentation System:

- **Fiber Optics:** This includes distributed fiber optics for real-time monitoring of structural changes in mines and tailings dams.
- **Environmental Sensors:** Like weather stations for monitoring atmospheric conditions and climate impact on mines and tailings.
- **Geotechnical and Structural Health Monitoring Sensors:** Developed with Electron Beam welding for robust performance.
- **Subsurface Measuring Tools:** Multi-sensor approach to monitor conditions affecting structural integrity.

Key Monitoring Parameters for Sensors:

- **Water Level and Pressure:** Using Piezometers.
- **Lateral Movement and Inclination:** Monitored with In-place inclinometers (with Settlement [3D]) and Tilt Meters.
- **Deformation and Settlement:** Tracked using Extensometers, Crack and Joint meters, and Creep Meters.
- **Load/Force:** Measured by Center Hole Load Cells, Resistance Strain Gage.
- **Rainfall and Weather:** Monitored through Rain Gages and Weather Stations.
- **Convergence:** Monitoring with Prism Targets and Automatic Total Station, or Laser Scanners, or RF Lora Tilt + Laser.
- **Stress:** Vibrating Wire Pressure Cell- shotcrete, soil or concrete, Borehole Stress Meter.
- **Strain:** Fiber Optic Sensors or Arc Weldable Strain Gage.
- **Seepage:** Automatic Seepage Monitoring Sensor
- **Vibration Levels:** To monitor the impact of mining and natural seismic activity.
- **Rockbolts**

NexaWave IoT Integration:

- **Data Loggers and Communication Systems:** Compatible with various sensors for comprehensive data collection and transmission, including RF LoRa nodes and gateways.

Visual Inspection and Area Analysis:

- Regular inspections to identify potential risks specific to mines and tailings dams, such as structural weaknesses, water seepage, or chemical leakages.

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DATA INTEGRATION THROUGH PROQIO

Infinitus, through its advanced platform Proqio, ensures effective data integration tailored for mines and tailing dams. This process results in user-friendly and customizable reporting, augmented with AI algorithms that prompt timely actions for mining safety and efficiency.

Core Functionality of Proqio in Mining Context:

- **Cross-Platform Data Integration of Diverse Mining Data Sources:** Proqio excels in combining data from mining-specific ground sensors, advanced surveying equipment, and satellite imagery, along with GIS layers. This integration is crucial for providing a comprehensive view of the mine's and tailing dam's status, ensuring seamless data merging from varied platforms like digital twins of mines and tailing dams, BIM (Building Information Modeling), drone imagery, construction progress, scheduling, geological data, and event logs.
- **Customizable Data Representation for Mining Needs:** Proqio offers a range of visualization options tailored to the mining sector, including digital twins of mines and tailing dams, 3D geological maps, trend analysis, interactive graphs, and dashboards catering to diverse stakeholder requirements in the mining industry.
- **AI and Machine Learning Adapted for Mining:** The platform's AI and ML capabilities are specially tuned for mining operations, analyzing vast data sets from mine-specific parameters and sensing methods. This technology is key in forecasting geological risks, predicting structural weaknesses in tailing dams and preparing for future mining operational challenges.

Benefits of Using Proqio:

- **Customizable and Scheduled Reporting:** Proqio's reporting functions are tailored to meet mining operations' unique reporting needs and preferences.
- **Alarm System for Early Warning in Mines:** The platform includes an advanced alarm system, crucial for early warning of potential risks in mines and tailing dams, thereby enhancing proactive risk management.
- **Real-Time Dashboards for Instant Insights:** Proqio provides virtual dashboards for real-time monitoring, offering instant insights into safety and integrity.
- **Flexibility, Control, and Security Over Mining Assets:** Users in mining operations can access and manage data in ways that best suit their site-specific and operational needs, ensuring control and security over their assets.
- **Scalability and Customization for Mining Environments:** Proqio's scalability allows it to be customized according to different mining sites and tailing dam requirements, aligning with various operational scales and environmental conditions.

Specialized Application for Mines and Tailing Dams Monitoring:

- **Proactive Monitoring of Geological and Structural Integrity:** The platform's capabilities are particularly beneficial for monitoring the unique conditions of mines and tailing dams, supporting a proactive approach to safety and operational efficiency.
- **Enhanced Predictive Maintenance in Mining Operations:** Leveraging AI and ML algorithms with specialized mining data, Proqio significantly bolsters the ability to predict and address potential risks in mines and tailing dams before they escalate.

Ensuring Safety and Integrity in Mining Operations: Proqio is critical in ensuring the safety and structural integrity of mining infrastructures and tailing dams. Its advanced data integration and real-time control and monitoring create a robust and reliable platform for effective risk management in the mining sector.

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DATA ANALYSIS & UNDERSTANDING

This phase is centered on the comprehensive analysis and understanding of the collected data, tailored for mines and tailing dams. Accurate interpretation of this data is crucial for informed decision-making and effective risk management in mining operations.

RISK ASSESSMENT AND ALARM MANAGEMENT SYSTEM

The critical phase in the Infinitus approach for mines and tailings dams involves thorough risk assessments and a robust alarm management system, which is crucial for identifying high-risk areas and developing preventive measures to mitigate these risks.

Key Components of Data Analysis and Understanding in Mining Context:

Change Detection:

- Monitoring changes over time in all the parameters monitored.
- Utilizes data from sensors, advanced surveying, and remote sensing techniques.

Data Reporting:

- Systematic reporting of findings and insights derived from the analysis of data.
- Keeps all stakeholders, including mine operators and safety officials, informed with the latest information.

Data Understanding:

- In-depth analysis of mining data to understand underlying geological patterns and structural implications.
- Identifying minute changes in terrain, analyzing subsurface conditions, and pinpointing structural weaknesses in mines and tailing dams.

Data Validation:

- Ensuring the accuracy and reliability of collected data through rigorous validation processes.
- Cross-referencing different data sources to confirm findings and reduce the likelihood of false positives in risk detection.

GIS Integration:

- Merging collected data with GIS layers to enhance spatial analysis and visualization specific to mining areas and tailing dams.
- Provides a comprehensive geographical context, aiding in identifying risk-prone areas and planning for mitigation strategies.

Digital Twins:

- Creating digital twins of mines and tailing dams for a virtual representation of these structures.
- Allows stakeholders to interact with and examine detailed models of the mining area, enhancing understanding and scenario planning.

Establishing Systems for Susceptibility Determination:

- Developing systems to identify areas within mines and tailing dams more susceptible to risks such as structural failures, water infiltration, or chemical leaks.
- Aids in focused monitoring and implementation of preventive measures.

Susceptibility Mappings for Mines and Tailing Dams:

- **Static Mappings:** Illustrate the inherent risks in mining areas and tailing dams, considering factors like geological stability and historical data.
- **Dynamic Mappings:** Adjust susceptibility values based on dynamic factors such as recent mining activities, rainfall, and seismic events.

Importance in Mining Operations:

- This step is critical in transforming raw data into actionable intelligence, enabling mine operators to identify potential risk areas in mines and tailing dams preemptively.
- Supports the implementation of necessary precautions and mitigative actions to ensure safety and operational continuity in mining environments.

Critical Components of Risk Assessment and Alarm Management in Mining Context:

Analyzing Collected Data for Risk Assessment:

- Utilizes all data gathered from previous steps to assess potential risks in mining areas and tailing dams, focusing on geological stability, structural integrity, and environmental impact.
- Identify areas with a high likelihood of structural failures, hazardous seepage, or other mining-related incidents.

Proqio Warning System via Alarms:

- An advanced alarm system integrated within the Proqio platform.
- Provides timely alerts and warnings based on the risk assessment results.

Integration with Asset Risk Management Systems:

- Aligns and complements mine-specific risk assessment protocols and existing alarm systems.
- Enhances the overall effectiveness of the mining monitoring system through this collaborative and integrated approach.
- Integration with Other Disaster Management Systems

Features of the Alarm Management System:

- **Control:** Ensures the system remains under constant surveillance and control for immediate action when needed.
- **Safety:** Prioritizes the safety of the infrastructure and the populace in landslide-prone areas.
- **Flexibility:** Adapts to different scenarios and risk levels, providing tailored responses based on the severity of the assessed risk.

Planning Preventive Measures:

- Based on the risk assessments, strategies, and measures are planned to mitigate potential impacts in mines and tailing dams.
- Involves real-time communication and response protocols, coordinating with mine management, emergency services, and other relevant stakeholders for implementing these measures.

Importance in Mining Operations:

- This step is essential in transitioning from monitoring and analysis to actionable responses within the mining sector.
- It plays a key role in preemptively alerting and mobilizing response teams, thereby contributing to the prevention of accidents, minimizing environmental impact, and reducing potential damage to mining infrastructure.

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CONTINUOUS MONITORING AND PREDICTIVE INTELLIGENCE

The final step in the Infinitus approach, tailored for mines and tailing dams, focuses on continuous vigilance and leveraging predictive intelligence. This phase is vital for maintaining an up-to-date understanding of mine and tailing dam conditions and proactively managing potential risks.

Key Components of Continuous Monitoring and Predictive Intelligence

Continuous Monitoring:

- Ongoing surveillance of mining areas and tailing dams to detect changes, movements, or potential failures.
- Regular updates to risk assessments based on the latest monitoring data.
- Ensures that the monitoring system remains accurate and relevant over time.

Predictive Intelligence:

- Utilizing collected data to forecast potential scenarios specific to mining operations and tailing dam stability.
- Aids in predictive maintenance and real-time monitoring, enhancing readiness and response strategies for mine-specific challenges.

Reporting and Dashboards:

- Utilizing Proqio to provide comprehensive reporting and real-time dashboards.
- Enables easy access to current data and insights for stakeholders, enhancing communication and decision-making.

Advanced Visualization Techniques:

- Offering immersive and interactive visual representations of infrastructure data.
- Facilitates a deeper understanding of complex data sets and enhances decision-making processes.
- Includes tools such as 3D mapping, digital twins, and other visualization technologies.

Benefits of Continuous Monitoring and Predictive Intelligence:

- Enhanced Awareness: Keeps a constant check on the operational state of mines and tailing dams, identifying potential risks early.
- Proactive Risk Management: Empowers mining authorities and stakeholders to take proactive safety measures based on predictive insights.
- Informed Decision-Making: Facilitates well-informed decisions through continuous data flow and advanced visualization, which is crucial in dynamic mining environments.

Importance in Mining Operations:

- Ensures the monitoring system is dynamic and adaptable to the changing conditions typical in mines and tailing dams.
- Promotes a proactive approach to managing mining and environmental risks, shifting from a reactive to a preventive paradigm.

Ensuring Reliability and Accuracy:

- Regular calibration and maintenance of mining monitoring equipment and systems are essential.
- Continuous refinement of AI models and algorithms, incorporating new data and insights for more accurate predictions and risk assessments.

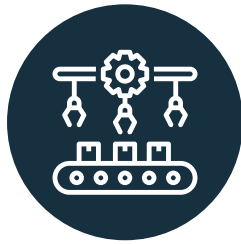
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Why Encardio?



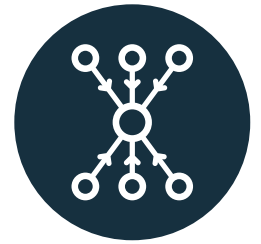
50+ Years
1000+ Projects
Unparalleled Expertise



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Contact across
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Infinitus across diverse applications



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