

A yellow front loader is the central focus, positioned in a quarry or construction site with large piles of grey material in the background. In the foreground, two computer monitors are visible, displaying technical data and graphs, suggesting a control room or monitoring station. The overall scene is set against a blue-tinted background.

# DFI

## Safer, Smarter, Greener: How AI is Advancing Industrial Safety and Sustainability in Smart Mining and Beyond

Industrial safety remains a critical concern across high-risk sectors like mining, construction, and automation. Mining, in particular, has long faced high injury rates—machinery alone accounted for a significant portion of operational hazards. According to the U.S. Mine Safety and Health Administration (MSHA), the mining industry recorded 31 worker fatalities in 2024. The financial toll was also substantial, with safety violations and regulatory enforcement leading to \$68.9 million in assessed penalties. These figures reflect not only the persistent danger to workers, but also the rising cost of noncompliance for operators.

Industry: **Mining, Construction, Industrial Automation and Warehouse Automation**

Application: **Mining Vehicles, Construction Vehicles, and Warehouse Vehicles**

Solution: **DFI [VC500-CMS](#) / [VC500-CMS-MXM](#)**

At the same time, industries are under mounting pressure to meet Environmental, Social, and Governance (ESG) standards—from reducing emissions to protecting worker well-being. In response, many are turning to artificial intelligence (AI), automation, and the Internet of Things (IoT) to drive improvements in both safety and sustainability—reducing incidents, minimizing operational disruptions, and supporting ESG compliance.

To help industries navigate this critical transformation, **DFI has partnered with LivNSense**, a leading industrial AI company based in India. Together, they are developing an **innovative edge-to-cloud AI-driven monitoring solution** designed to enhance safety compliance, improve operational efficiency, and reduce carbon emissions. This strategic collaboration demonstrates how AI and embedded edge computing can work hand-in-hand to address both regulatory and ESG challenges in real-world industrial environments.

## Heavy Industries, Higher Stakes: Challenges Facing Mining and Construction

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Mining and construction operations are facing a confluence of operational, safety, and environmental pressures that can impact both profitability and public trust:

- **Climate Change & Environmental Impact:**

Activities in these sectors often generate heavy dust, high carbon emissions, and intense vibrations, causing pollution and accelerating climate change.

- **Workplace Safety & Risk Mitigation:**

Heavy machinery, high-risk tasks, and constantly changing site conditions create an environment where even small errors can lead to serious accidents.

- **Legal Risks Are Rising:**

Courts are increasingly issuing large verdicts for industrial negligence—especially in mining and construction. These so-called “nuclear verdicts” reflect growing public and legal scrutiny. Companies that fail to manage safety and ESG risks now face not just regulatory fines, but also lawsuits with severe financial and reputational consequences.

- **Evolving ESG & Regulatory Compliance:**

Governments and stakeholders now expect detailed sustainability and workforce safety reporting. The [IFRS 2023 guidelines](#), for example, require companies to report climate-related risks and show more accountability for human rights policies.





## From Edge to Operational Insight: AI in a Real-World Mining Deployment

To address the pressing challenges of operational safety, environment risk and regulatory pressure in mining and heavy industries, DFI partnered with LivNSense to develop and implement an edge-to-cloud AI monitoring solution for India's mining sector – a critical industry contributing approximately 2.5% to the national GDP. As the world's second-largest producer of coal and steel, and a key supplier of zinc and iron ore, India faces increasing pressure to modernize its mining operations, particularly around safety compliance and environment accountability. With the AI-driven monitoring solution, DFI and LivNSense have empowered India's mining industry to advance towards smarter, safer and more sustainable operations.

### DFI and LivNSense Power Smarter Mining from Edge to Cloud

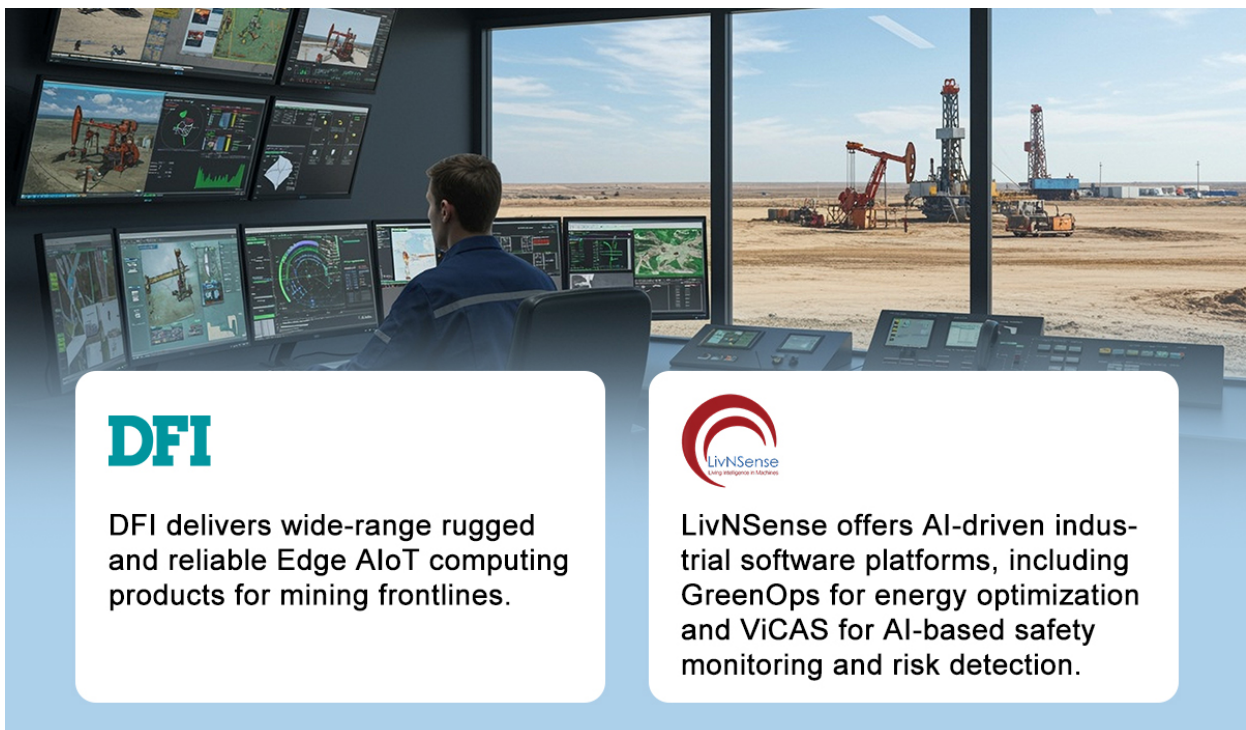
## DFI x LivNSense : ESG-Ready, AI Powered Industrial Safety Solution



At the core of the solution is LivNSense's ViCAS (Vision-based Cognitive Automation System). Powered by Intel® OpenVINO™ Toolkit, ViCAS, serving as the central mining command center at the edge, harnesses advanced AI and ML to continuously analyze real-time camera data to detect anomalies and identify potential hazards like falling rocks or collapse across a range of scenarios to prevent accidents and environmental risk. ViCAS sends real-time and predictive alerts through visual and natural language interfaces to support proactive safety management. When integrated into on-site industrial vehicles or equipment such as forklifts or mining vehicles, ViCAS acts as an industrial "Co-Pilot", using its self-learning AI capabilities to enhance site safety, reduce operational waste, and improve carbon efficiency.

Complementing this, GreenOps, deployable in both public and private clouds, collects real-time data from ViCAS. Leveraging AI and digital twin technology, GreenOps tracks and analyzes carbon emissions, energy consumption, workforce safety, and delivers predictive and actionable insights that help operators improve their ESG reports across energy efficiency, sustainability metrics, and overall operational processes.

The ViCAS and GreenOps AI monitoring platform has already proven its value in controlled indoor environments like warehouses. In these settings, the system precisely monitors worker posture and movement, detects personal protective equipment (PPE) for compliance, tracks forklift activity and pallet handling, and delivers real-time task guidance and alerts through generative AI. These capabilities have led to tangible gains in safety and energy efficiency. However, the true test of industrial AI lies outdoors. In unpredictable and extreme environments like mining and construction, where dust, vibration, harsh weather, and rugged terrain are daily challenges, the complexity multiplies. This is where DFI's rugged edge AI computers stand out—delivering the durability, performance, and reliability required for seamless AI operation in the most demanding environments.



**DFI**

DFI delivers wide-range rugged and reliable Edge AIoT computing products for mining frontlines.

**LivNSense**

LivNSense offers AI-driven industrial software platforms, including GreenOps for energy optimization and ViCAS for AI-based safety monitoring and risk detection.

# DFI's VC500-CMS Driving Edge AI in Smart Mining and Scalable Industrial Applications

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At the heart of this transformation is DFI's [VC500-CMS](#) / [VC500-CMS-MXM](#), an in-vehicle Edge AI computing system built to handle robust AI processing in harsh and unpredictable environments. With the support of partner LivNSense, the system has been integrated with LivNSense's ViCAS and GreenOps platforms and successfully deployed across India's mining operations for smarter, AI-driven safety and environment monitoring.

- **Reliable Design**

Built for extreme resilience, DFI VC500-CMS series withstands up to 3G vibration and 40G shock and operates reliably between -20°C and 70°C. This ensures consistent performance of the ViCAS monitoring platform in mobile and heavy-duty applications across mining sites.

- **Scalable AI and High Speed I/O**

Powered by 10th Gen Intel® Xeon®/Core™/Pentium®/Celeron® processors and scalable with MXM GPU modules, the VC500-CMS series effortlessly handles demanding AI and computer vision workloads from ViCAS. Its high-bandwidth I/O configuration, including four lockable M12 or RJ45-type 802.3af PoE ports and two ultra-fast 10G SFP+ ports, enables high-speed, reliable data transmission for real-time camera feeds and seamless integration with diverse mining equipment.

- **Wide Range Power Input for Mobile Deployments**

With a wide 9V–50V power input and intelligent ignition control, the VC500-CMS series ensures stable operation of ViCAS in mining vehicles like trucks and excavators, preventing unexpected shutdowns and protecting battery life.

- **Reliable Connectivity Anywhere**

To maintain uninterrupted connectivity in remote mining areas, the VC500-CMS series supports M.2 B-Key 3042/3052 5G NR modules and dual external-access SIM card slots to ensure constant communication between ViCAS at the edge and the GreenOps platform in the cloud. It also features two COM ports that support CANBus 2.0A/2.0B/FD and OBDII for seamless integration and data exchange with mining vehicles and heavy machinery.

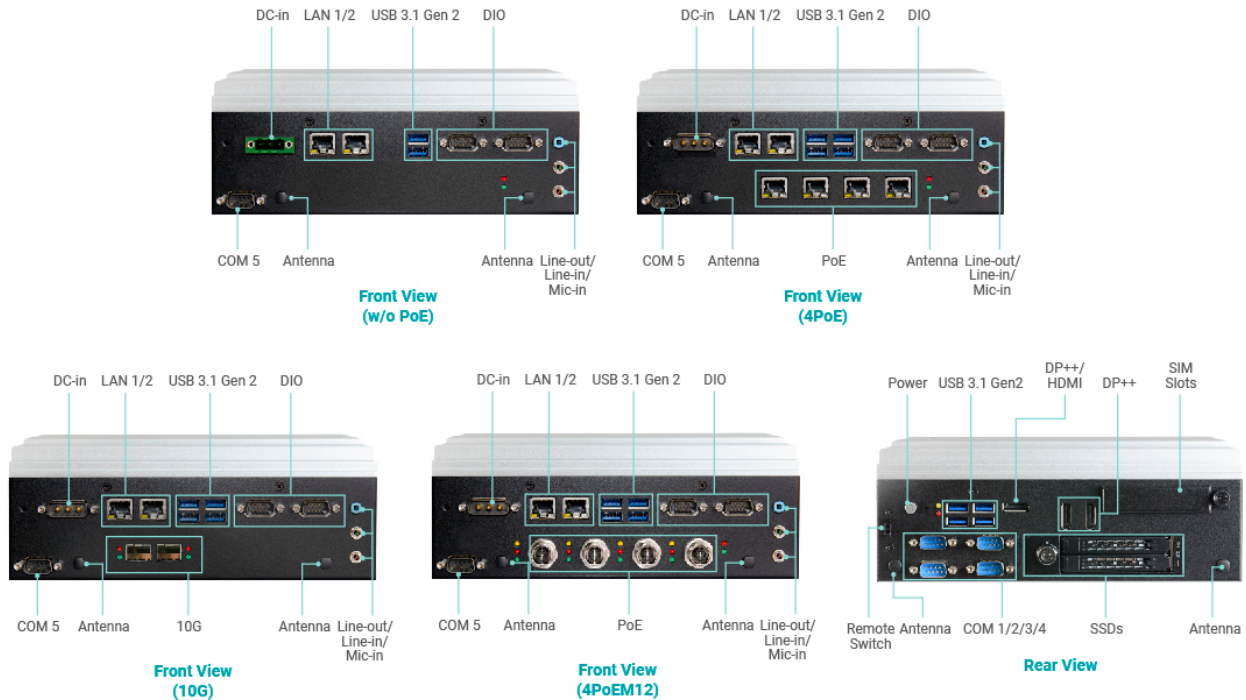
- **Out-of-band (OOB) Remote Management**

The system supports optional OOB remote management via a dedicated network module, enabling hardware-level over-the-air (OTA) BIOS and OS updates, remote system on/off control, and recovery—enabling centralized monitoring and maintenance of the mining vehicle fleet from afar.

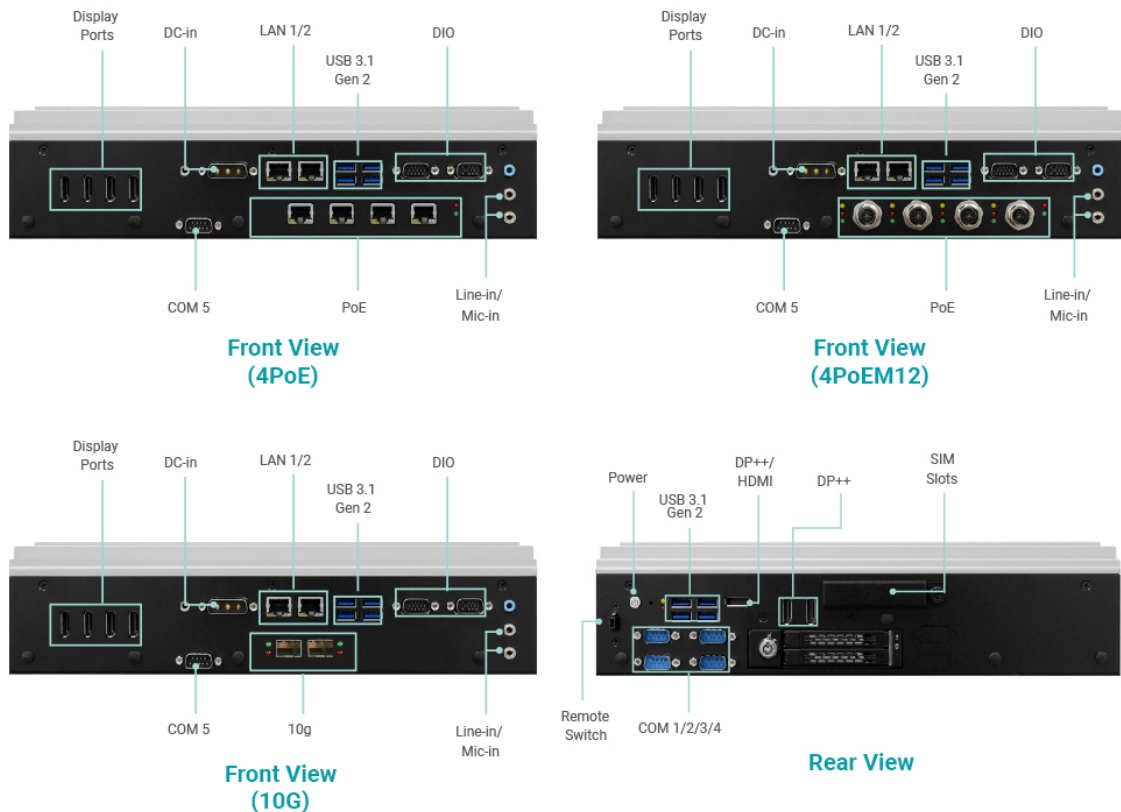


DFI and LivNSense's joint AI-driven monitoring solution has already transformed how the Indian mining operators manage risk and sustainability. By digitizing their monitoring processes, they now benefit from real-time alerts, predictive insights, and full ESG visibility, which allows them to improve workplace safety, reduce carbon emissions, and stay ahead of evolving regulatory expectations.

### VC500-CMS FRONT & REAR View



### VC500-CMS-MXM FRONT & REAR View



# Driving Digital Transformation with DFI's Industrial Edge AI Computing Systems

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DFI's edge AI systems are at the forefront of driving digital transformation across industries that demand both resilience and intelligence. Designed for rugged performance in challenging field conditions, these edge AI systems are tailored to meet the demands of real-world industrial environments, from mining sites to heavy-duty construction zones.

Besides extremely harsh environments, DFI's industrial-grade systems are also accelerating factory automation and smart manufacturing. The [EC700-ASL](#) edge AI embedded system, also the [EC600-RPS](#) and [EC633-RPS](#) fanless embedded systems, are tailored for demanding industrial environments. While accelerating AI workloads via multiple M.2 expansion slots, these systems maintain stable operation under MIL-STD-rated shock and vibration conditions. With a wide operating temperature range, rich I/O options for seamless integration, and support for out-of-band (OOB) remote management, DFI's industrial PCs deliver both performance and reliability for mission-critical industrial applications.

In addition, by leveraging the strength of its strategic partners in the AI ecosystem, DFI accelerates the deployment of cutting-edge AI systems that bring real-time decision-making and predictive capabilities to the edge. These partnerships enable seamless integration of AI-powered platforms that enhance safety, streamline operations, and support ESG compliance. As businesses move toward smarter, safer and greener practices, DFI stands as a trusted enabler of next-generation edge AI transformation.

# DFI

Founded in 1981, DFI is a global leading provider of high-performance computing technology across multiple embedded industries. With its innovative design and premium quality management system, DFI's industrial-grade solutions enable customers to optimize their equipment and ensure high reliability, long-term life cycle, and 24/7 durability in a breadth of markets including factory automation, medical, gaming, transportation, smart energy, defense, and intelligent retail.

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