MRTECH Ready For Tomorrow

White Paper: Robotics with Computer Vision for Remote & Autonomous Inspections in High-Dust Mining Environments

Executive Summary

High-dust environments in mining operations, such as crushing plants, present significant challenges to worker safety and operational efficiency. Traditional inspections require workers to enter hazardous zones, risking exposure to suspended dust. This white paper explores a partnership between **MRTECH** and a **global leading mining company**, introducing a cutting-edge robotics system equipped with advanced computer vision. The solution enables fully automated remote inspections, reducing human exposure, enhancing operational efficiency, and aligning with the mining industry's safety and sustainability goals.



Introduction: The Challenge of High-Dust Inspections

Mining operations, particularly in crushing plants, generate substantial levels of airborne particulate matter. At [Mining Company], inspections of equipment and infrastructure are conducted in high-dust zones, including conveyor systems and stockpile areas. These inspections, carried out approximately four times per shift, expose personnel to harmful conditions and create operational inefficiencies.

Key Challenges:

- Health Risks: Workers face exposure to suspended dust, leading to respiratory health issues.
- **Operational Delays**: Manual inspections require equipment downtime, reducing productivity.
- Lack of Automation: No existing solutions fully automate inspections in such hazardous environments.

Objective

Deploy a robotics system integrated with advanced computer vision to enable autonomous, remote inspections. This solution aims to:

- 1. Eliminate human presence in high-dust zones.
- 2. Ensure continuous, accurate, and efficient monitoring.
- 3. Minimize downtime while enhancing worker safety.

Use Case Overview: Robotics with Computer Vision for Autonomous Inspections



- AI-Powered Anomaly Detection: Real-time processing identifies equipment and infrastructure issues.
- **3.** Connectivity and Automation
- **5G and IoT Integration**: Enables real-time data streaming and seamless connectivity with centralized monitoring systems.
- Cloud-Enabled Insights: Synchronizes inspection data with operational systems for actionable insights.
- Autonomous Operation: Robots execute pre-programmed routes and utilize AI for adaptive decision-making.

4. Self-Cleaning Features

Integrated air-jet systems keep lenses and sensors clean, ensuring uninterrupted performance even in extreme dust conditions.

Key Differentiators

- Worker Safety: Eliminates worker exposure to hazardous environments.
- **Continuous Operations**: Enables real-time inspections without downtime.
- **Proven Reliability**: Validated through rigorous testing in operational environments.
- Sustainability Focus: Aligns with ESG goals by prioritizing safety and operational efficiency.

Implementation Process

Phase 1: Pilot Deployment

- Site Selection: Identify a crushing plant for initial deployment.
- System Installation: Set up robotic units and communication infrastructure.
- Validation: Test mobility, computer vision accuracy, and system integration.

Phase 2: Optimization and Training

- Customization: Refine navigation and vision algorithms based on sitespecific needs.
- **Training**: Equip personnel with skills to monitor and manage the system.

Phase 3: Full-Scale Deployment

- Expansion: Deploy across multiple facilities.
- Maintenance Protocols: Establish service schedules to ensure long-term reliability.

Expected Outcomes

1. Improved Safety

- Eliminates human exposure to hazardous dust zones.
- Reduces risks of respiratory illnesses and dust-related health concerns.

2. Enhanced Efficiency

- Automates inspections, reducing downtime and increasing equipment uptime.
- Provides real-time data for proactive maintenance.

3. Cost Savings

- Lowers operational costs through reduced downtime and improved maintenance efficiency.
- Minimizes potential liabilities related to worker health and safety.
- 4. Sustainability and ESG Compliance
- Demonstrates commitment to environmental and social governance goals.

Pilot Results at [Mining Company]

A pilot deployment of the system achieved the following outcomes:

- 100% Reduction in Worker Exposure: Autonomous robots performed all inspections without human presence in high-dust areas.
- **60% Reduction in Inspection Time**: Robots conducted inspections significantly faster than manual processes.
- **High Accuracy**: Computer vision maintained over 95% detection accuracy despite adverse conditions.

Conclusion and Call to Action

Robotics with Computer Vision provides a transformative solution for remote inspections in high-dust mining environments. By adopting this technology, mining companies can achieve unparalleled safety, efficiency, and sustainability.

MRTECH, The global leading turn key solution creator and distributor for 5G XR Drone Robotics and IOT, is at the forefront of delivering innovative solutions for industrial digital transformation. Contact us to learn how we can revolutionize your inspection processes and drive sustainable success in mining operations.