Falls and dangerous items no longer threaten miners.

A huge mining machine in Bílina mine now features eyes of Axis cameras.

Organization:
Severočeské doly a.s.

Location:
Czech Republic

Industry segment:
Critical infrastructure

Application:
Safety and security, operational control

Axis partners:
ENELEX s.r.o., Milestone

Mission

Surface mining is routine at numerous locations. Giant excavators cut the pieces of soil, layer by layer, and conveyor belts take the material away. However, a completely non-standard situation arose in the North Bohemian brown coal basin, when history interfered with mining. The Bílina mine area features various dangerous items like unexploded Nazi ammunition from the second World War. And since the control cabin of the K10000/K74 mining machine is located very close to the excavator, there is a risk that a potential explosion will directly endanger the operator's life and health. The mission was simple in the assignment, but the solution was not. Moving the controls to a back-up location deep in the bowels and safety of the mining machine, and using a camera system provide the operator with the same view as from the original cabin. This non-standard requirement was a challenge for the integrator. It had to invent a unique custom-made solution without compromising the mining machine's functions or possibilities.

Solution

After ENELEX's long-term experience with the Axis IP cameras, there was no other choice but to base the whole system right on this brand. Reliability and durability under heavy conditions were a must, and the biggest enemies were dustiness and vibration during the machine's operation. In total, 18 AXIS Q3505-VE Network Cameras have been installed to deliver video to three different locations, providing a secure working environment for employees.

Result

Now, the two cameras on the control cabin have a viewing angle exceeding 180° and provide a better view than the operator had previously. The system is built autonomously, automatically starts up when the machine is turned on, and each of the power nodes has a separate back-up battery to keep the system running even in emergencies. Mining is now safe thanks to technology, and even if any old ammunition surfaces, the excavator operator's life is no longer at risk.

AXIS COMMUNICATIONS

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"We have been using Axis cameras for years and after a big internal benchmarking test completed a few years ago, we did not use any other brands for our mining equipment. Our first camera used at a mining company, AXIS 221, still works at a gatehouse even after many years."

Lukas Vacek, ENELEX Director of Operations.

"Greetings" from the second World War

During the second half of the war, Bohemia served Nazi Germany as a major supplier of weapon systems and equipment for its military. The occupied allied country avoided the heavy raids that plagued Germany, but still did not escape the war. One of the targets was a chemical factory located near Most. During one raid, it was bombed along with an anti-aircraft battery that protected it, and the remains of these batteries are a threat to the miners now. The batteries were to fire 105- and 128-mm caliber fragmentation projectiles to the height of 10 km, where they then exploded and to damage or destroy enemy bombers.

Many of these unused projectiles and their powder compounds are still hidden under the layers of clay up to a depth of 5 m. If such a fragmentation projectile detonated on the ground, (e.g. upon its contact with the excavator), its fragments would be deadly within a distance of up to 1 km away from the explosion, if no cover is used. In addition, unexploded aircraft bombs have been found, and they pose a much greater risk. A lightly-panelled and glassed control cabin does not provide safety for the operator. Therefore, it was necessary to move the controls inside the machine in the case of extraction in the hazardous area, where the operator is protected by the entire excavator's massive structure.

Greater capacity to monitor and respond

Installed directly on the control cabin, there are two AXIS Q3505-VE Network Cameras, each with its 105° viewing angle. Together with the other monitoring cameras, they feed 5 vertical monitors in the control room. Everything must be absolutely synchronized, 30 frames per second in maximum resolution, and almost zero latency. To achieve seamless transmission without any interference, it was necessary to install hardware whose performance exceeds the commonly used specifications several times. The core of the system consists of a 10 Gbit network for connecting servers and main client stations, and the camera backbone optical links are gigabit ones.

The whole system uses Milestone's XProtect® video management software. Everything has been designed with the utmost autonomy since the giant excavator operators are busy enough controlling the machine itself and cannot be distracted by any camera settings. Although they have access to features like digital zoom and others, they do not use them in the vast majority of cases.

Improved K10000/K74 mining machine

The old K10000/K74 colossus got much younger thanks to its new cameras. Not only do the cameras replace the man in the excavator control cabin now, another 16 cameras are also located at various locations on the machine's surface, providing complete video monitoring of the individual segments. They provide the operator with a view of the surroundings when moving his mining machine and of all its vital components. Although the crew remains the same, no lives are at risk while mining in dangerous zones. Overall, the machine contains one control computer and 4 client computers. The first one with five monitors is designed for controlling the machine from its backup control cabin, the second one features a total of 4 monitors for the crew's overview of the machine's operation, and the other two computers are used during regular operation in the "excavator operator" and "shutter operator" cabins, fed by 8 other cameras. "We were originally thinking about analytical features and the possibility to automatically stop the machine with the assistance of image analysis, but it is not possible due to the legislation. Decisions must be made by a man. The only advanced feature we have eventually utilized is image stabilisation. However, it was not enough for some cameras. The structure's vibration was so intense that we had to create a special mount with anti-vibration elements," says Lukas Vacek, Enelex Commercial Director, and adds: "We have been using Axis cameras for years and after a big internal benchmarking test completed a few years ago, we did not use any other brands for our mining equipment. Our first camera used at a mining company, AXIS 221E, still works at a gatehouse even after many years."

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