AI Empowered Indoor & Outdoor Facility Safety

Location: USA

Background Information

AI solutions can reduce worker contact injuries in logistic centers, warehouses, and construction sites. Contact with dangerous equipment causes thousands of injuries every year. Many of these injuries are avoidable using motion and infrared detection of people and objects near machines.

Modern construction sites utilize real-time visual detection systems that analyze 20 to 30 live streams simultaneously. In these systems, visual AI increases the visibility of on-site workers and equipment to improve responsiveness to potentially dangerous situations — such as an employee carelessly approaching moving machinery. Real-time video feeds are available via the cloud to any device with a screen. To avoid tragedies or accidents, real-time alerts are sent to screens; and via methods including SMS and email.

System Requirements

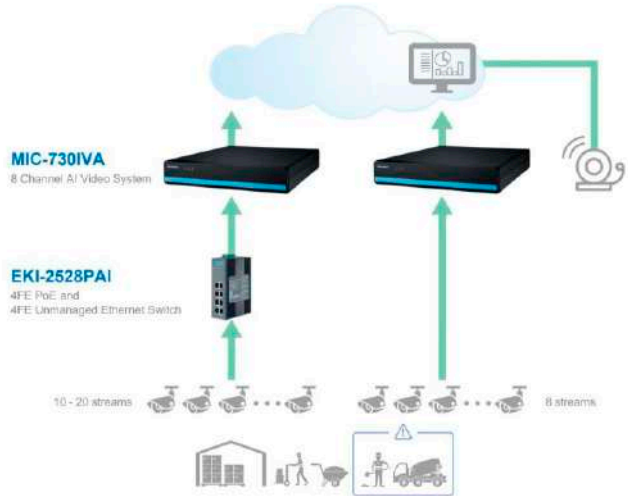
This project was necessitated by market demands for real-time AI-driven NVR systems. To improve worksite safety, these systems needed to incorporate both existing security cameras and newly installed high-resolution cameras into a single smart security system with AI software.

Likewise the AI NVR system needed to surveil numerous worksites simultaneously. It needed to minimize false alerts and send real-time warning alerts as dangerous events arise. Videos from the site should be sent to a control room for record keeping and detailed analysis. These records and reports can identify potentially dangerous on-site environments and improve worksite/facility safety.

System Description

High-resolution security cameras are the first of four layers on this worksite AI security system. The second layer is 4 ~ 30 live stream video cameras that utilize our customer's software running an NVIDIA® AGX Jetson Xavier™ system. This second layer processes frames in real-time and performs visual recognition to identify potentially hazardous events. When such events are identified, the third layer immediately receives the data needed to compile a warning alert. The alert is then displayed on-screen, and notifications are sent via SMS or email in the fourth layer.

System Diagram



The AI NVR system's spontaneous response time is crucial to improving safety. Advantech's MIC-730IVA is designed specifically for this AI NVR system. MIC-730IVA can directly receive eight real-time streams from cameras. By using EKI-2527PAI switches to expand MIC-730IVA this system can receive 10 ~ 20 video streams. Similarly, NVIDIA® AGX Jetson Xavier™ technology enables the simultaneous reliable processing of at least eight camera streams directly.

Product Introduction

MIC-730 IVA

MIC-730 IVA features 2x 3.5" 10TB SATA HDD, an AI storage technology from Seagate. The Seagate SkyHawk AI drive is designed for DVR and NVR systems. SkyHawk AI surveillance drives are equipped with enhanced Image Perfect™ firmware and SkyHawk Health Management. When combined with MIC-730IVA, Seagate SkyHawk AI drives deliver secure video storage for future video analysis.

- AI can reduce worker injuries in logistic centers, warehouses, and construction sites.
- AI NVR system needed to surveil numerous worksites simultaneously. It needed to minimize false alerts and send real-time warning alerts as dangerous events arise.
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EKI-2528PAI

4FE PoE and 4FE Unmanaged Ethernet Switch, IEEE802.3af, 24~48VDC, -40~75°C

- Provides 5/8 Fast Ethernet ports with 4 PoE ports with injector function
- Supports 10/100 Mbps Auto Negotiation
- Supports Ethernet ESD protection
- Provides power line EFT protection
- Provides slim size, DIN-rail/Wall mount with IP30 metal mechanism
- Supports Redundant 24/48 VDC power input and P-Fail Relay
- Supports wide operating temperature -40 ~ 75°C

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IAdvantech Routers Secure Remote Data Upload for Oil and Gas Industry

Market: Oil and Gas Industry
Application: Large Oilfield
Products: BB-SL30600110-SWH Cellular Router, EKI-2525I Industrial Ethernet Switch

Project background

As China's largest province, Xinjiang is subject to extreme differences in weather conditions, especially because altitudes range from sea level to mountainous peaks above 6,000 m. Subject to these conditions are thousands of oil pumpjacks owned by China National Petroleum Corporation (CNPC). Effective field device management is a major concern.

Challenge

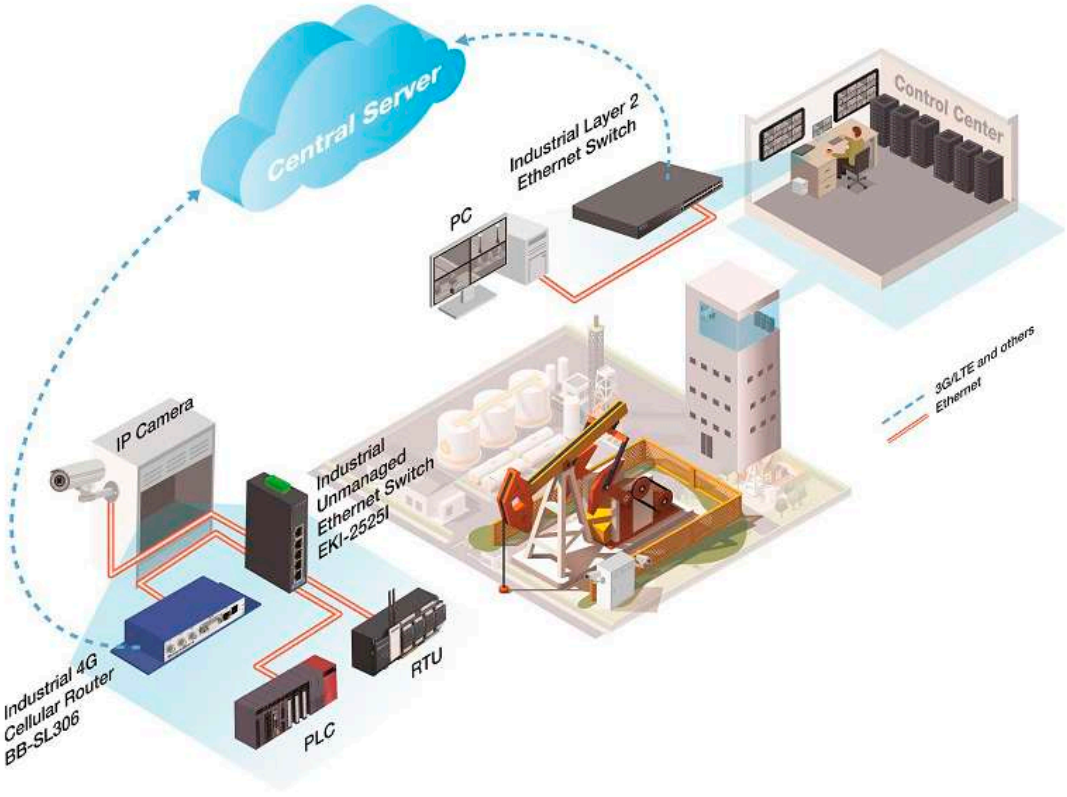
Like at many other oilfields, CNPC has in the past utilized GPRS DTU modems to upload field data, and this approach requires a hard connection to link equipment to the network. However, increasing field data throughput requirements and technical advancements have rendered DTU modems as a no longer feasible option. In particular, the limitation on data packet size and transmission bandwidth means that DTU modems are incapable of supporting video surveillance.

Surveillance data can be transmitted via wireless bridge or optical fiber cable, but this involves higher costs for both construction and maintenance. Recent advancements in mobile communication technology, however, have reduced the cost of network traffic by allowing for video surveillance data to be sent over a cellular network rather than a physical one.

Thus, to facilitate the acquisition of field data and management of field devices, CNPC decided to reform the data transmission systems employed at some of its oil wells.

System Requirements

To enhance data transmission capabilities while reducing related costs, CNPC opted for a wide area network (WAN) solution at the oilfield. This means that data can be transferred via cellular network from the oilfield to the CNPC platform. To ensure sufficient data bandwidth for live video, 3G/4G connectivity was required. Besides, since the WannaCry global ransomware attack in 2017, CNPC has also implemented special requirements for Internet security, meaning that how to secure data transmission was a major focus of this reform. Advantech was thus consulted to provide a suitable solution.



Solution

For industrial cellular routers, Advantech recommended adopting the BB-SL306 4G router, which features a 4G communication module designed by Huawei technologies and is widely praised for its high stability in industrial applications. This unit provides ample CPU power (1 GHz), RAM (512 MB), and flash memory (256 MB). Furthermore, it supports 4G Full Netcom in China and has an SDK for Python on Linux. It also provides RS-232 and digital I/O connectivity options. The BB-SL306 also has a wide operating temperature (-40 to 75°C), and as such can also handle extreme weather conditions.

The BB-SL306 routers were installed with EKI-2525I switches in cabinets beside the pumpjacks, providing network connectivity for field equipment such as cameras, PLCs, RTUs, and other devices. The expansion slots on the EKI-2525I mean that these units are highly effective as hubs for field devices and routers. Like the BB-SL306, the EKI-2525I supports a wide operating temperature range (-40 to 75°C), making it suitable for

applications in harsh environments. With this solution, field equipment data could be uploaded to the central platform.

Compared with solutions offered by our competitors, the BB-SL306 offers higher security and higher performance, supporting multiple VPN connections and software firewalls. Also, through the use of SIM cards from CNPC and China Unicom, IP addresses were controlled to ensure secure data transmission to the central platform.

In this reform, the use of static IP addresses allowed for safe network address translation, meaning that inspection personnel can directly access and troubleshoot multiple oil wells at the same time, which was previously impossible with DTU modems. Thus, future field inspections will be more efficient.

Features, Benefits, and Advantages

Features	Benefits	Advantages
SDK for Python on Linux	Support self-development	High flexibility
Multiple port connectivity	Can be hard-connected to various devices	
NAT functionality	Remote monitoring	High convenience
VPN functionality		
Wide operating temperature range (-45~75°C)	Durable under harsh conditions	Suitable for weather extremes in Xinjian
Huawai 4G module	Reliable 4G signal	Stable and reliable
VPN	Enhanced data security	
Firewall		

Conclusion

After installation, staff has since been able to monitor field equipment via live video simply by logging onto the central platform, thus ensuring security of the oil wells. As for the background operations, the BB-SL306 router was configured to automatically upload the field data at set intervals. In the event of any abnormality with a field device, staff can now directly access the device of interest for remote troubleshooting via VPN, thus fully realizing the remote operation of field devices.

For more information, please contact info@advantech.net.au