Transforming Port Safety with Digital Twin and Video Analytics

Summary

INTECH partnered with a leading port and logistics operator to redefine safety and security using an innovative digital twin solution. It improved real-time operational visibility, enhanced incident response times, and ensured compliance with stringent safety regulations.

About the Client

The client, a prominent leader in the port and logistics sector, manages extensive port operations involving the movement and storage of high-value goods. Their facilities are key hubs for global trade, managing substantial volumes of cargo traffic on a daily basis.

To meet the demands of their complex and dynamic environment, the port operations needed and reliable way to ensure safety, prevent security breaches, and improve operational efficiencies.

Client Challenges

The client faced consistent safety and security challenges stemming from a lack of real-time visibility, and inadequate predictive insights. With limited integration with existing systems, the fragmented solutions hindered their ability to address risks effectively and respond to incidents promptly.

The key challenges included:

Security Threats
Cargo theft and unauthorized vehicle movements posed significant security risks.

Limited Insights
Existing systems lacked predictive analytics and real-time monitoring capabilities.

Safety Hazards
Frequent incidents of improper PPE detection, unauthorized access, and workers operating under suspended loads.

Delayed Incident Response
Delayed detection and response to incidents prolonged resolution times and increased operational disruptions.

INTECH's Solution

INTECH implemented an immersive digital twin solution in conjunction with advanced video analytics to enhance port safety and security. The solution created a virtual representation of the facility by leveraging real-time video data and machine learning to address 28 critical safety and security use cases.

Key Features

Real-Time Monitoring

▶ Integrated video streams analyzed using AI and ML algorithms to detect and classify objects and events.

Predictive Analytics

▶ Leveraged machine learning to anticipate incidents such as intrusions, PPE non-compliance, and unauthorized vehicle activities.

3D Visualization

▶ Created a digital twin with GIS-based 3D modeling for detailed spatial awareness and incident localization.

Proactive Alerts

▶ Triggered real-time alerts to preempt accidents and security breaches.

Implementation Process

1 Requirements Analysis
A thorough assessment of the client's safety and security challenges was conducted to identify high-priority use cases. System requirements were defined to ensure a targeted and effective solution.

2 Digital Twin Development
A detailed 3D model of the facility was created, integrating GIS surveys and spatial data layers. Real-time monitoring capabilities were added by embedding video analytics into the virtual model.

3 AI and ML Deployment
Custom AI and ML models were developed and deployed to address key use cases, including intrusion detection, PPE compliance monitoring, and vehicle tracking. These models were seamlessly integrated with the client's existing systems for a unified solution.

4 Testing and Optimization
The system underwent rigorous testing across devices and platforms to validate performance. Scalability and reliability were optimized for both on-premise and cloud-based environments.

Key Outcomes

The digital twin solution delivered measurable benefits to the client, transforming their approach to safety and security:

⚙ **Enhanced Operational Visibility:** Real-time 3D visualization enabled the site team to monitor activities effectively and respond quickly.

⚙ **Improved Incident Prevention:** Predictive analytics facilitated proactive measures, reducing accidents and security breaches.

⚙ **Faster Incident Response**: Automated alerts reduced response times and minimized operational disruptions.

⚙ **Regulatory Compliance:** Ensured adherence to safety protocols and improved incident documentation.

Tools and Technologies Used

⚙ **GIS Survey:** Provided detailed spatial mapping for enhanced incident localization.

⚙ **AI and ML Algorithms:** Enabled object detection and event classification in real-time.

⚙ **Machine Learning**: Addressed 28 safety and security use cases with advanced dataanalytics.

⚙ **3D Modeling:** Offered a dynamic, visual representation of the facility for improved situational awareness.