SPECTO Enhances Road Safety with Fast Incident Detection and Response

The R&D firm ISSD accelerates AI vision and lowers costs with the Intel® Distribution of OpenVINO™ toolkit and Intel® Movidius™ Myriad™ X VPUs

SPECTO

ISSD
INTEGRATED SYSTEMS & SYSTEMS DESIGN

Cities depend on their transportation infrastructure for industry and commerce and to stay connected. No infrastructure is more important than bridges, tunnels, and highways to keep traffic moving. But these areas are also the most vulnerable, as incidents involving collision, stopped or slowed vehicles, or inclement weather can have a huge impact on traffic in the surrounding area. These areas are also the most difficult to monitor in order to track incidents, notify response personnel, and clear roadways to keep things flowing while protecting drivers, passengers, and pedestrians. Traditional infrastructure typically relies on a network of closed-circuit television (CCTV) camera systems, which are monitored manually by human operators at a central traffic management office. However, it takes a tremendous number of human operators to monitor video feeds 24/7.

Challenge: Faster response means fewer accidents and injuries

Automated incident detection (AID) systems exist now that help automate the process of detecting incidents and events that could lead to incidents, such as stopped or slowed vehicles. These systems use legacy image-processing algorithms that rely on the CPU alone as a hardware accelerator, which is costly and doesn't scale well to multiple or different environments. Also, these systems are not well suited to complex changes in environment, such as when using pan-tilt-zoom (PTZ) cameras that cover a wide swath of roadway, or when fog or rain makes the environment much more difficult for computer algorithms to recognize objects. Processing time is essential. The faster a system can alert an operator to problems, the faster the operator can respond by helping dispatch response units to clear the roadway, or emergency crews to treat injuries.

Solution: Accelerated, cost-efficient, AI-enabled AID software

ISSD SPECTO is an AID software solution that supports continuous, automated incident detection. It can adapt to shifting backgrounds, as in the case of PTZ cameras, and different weather conditions with higher accuracy than older, CPU-only AID configurations. When an incident occurs, SPECTO can alert human operators in less than 10 seconds,[1] enabling them to act quickly. This is made possible through the use of AI visual acceleration through the Intel® Distribution of OpenVINO™ toolkit, combined with Intel® Movidius™ Myriad™ X VPUs. According to Enes Yüncü, CTO at ISSD, "With the help of the Intel Distribution of OpenVINO toolkit, we improved the accuracy and response time of SPECTO. With this affordable and easy-to-adapt, Intel-based software toolkit, we built a structured backbone of deep learning in our traffic incidents detection solution."

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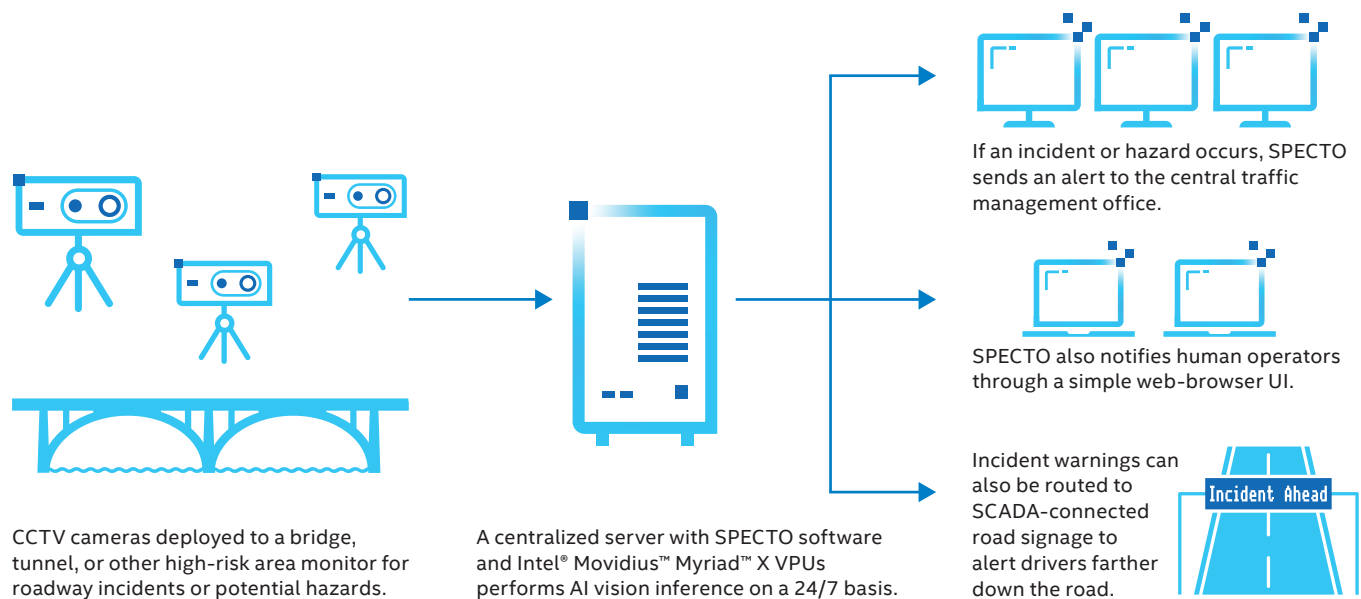
—Enes Yüncü, CTO, ISSD

OpenVINO™

How it works

CCTV cameras at the roadway location transmit visual data to a centralized server equipped with Intel Movidius Myriad X VPUs and the SPECTO software that's optimized using the Intel Distribution of OpenVINO toolkit. This centralized server generates vision inference results and then triggers additional behaviors based on incident detection. If an incident requires attention, SPECTO will send alerts to both the central traffic management office, which can be displayed on the video wall, and to individual operator PCs. Operators can then respond to the alerts through a simple web-browser interface and take action as needed. System architects can also connect the SPECTO software to a supervisory control and data acquisition (SCADA) system. When an incident occurs, SPECTO can automatically trigger the SCADA system to post warnings or advisories to digital signs farther up the roadway, instructing drivers to slow down when approaching a hazard.

SPECTO can automatically detect and notify human operators about:

- Pedestrians in vehicle-only zones
- Stopped or slowed vehicles
- Vehicles traveling the wrong direction
- Dropped objects and debris
- Smoke and fire
- Vehicle count and density

CCTV cameras deployed to a bridge, tunnel, or other high-risk area monitor for roadway incidents or potential hazards.

A centralized server with SPECTO software and Intel® Movidius™ Myriad™ X VPUs performs AI vision inference on a 24/7 basis.

If an incident or hazard occurs, SPECTO sends an alert to the central traffic management office.

SPECTO also notifies human operators through a simple web-browser UI.

Incident warnings can also be routed to SCADA-connected road signage to alert drivers farther down the road.

Incident Ahead

Figure 1. SPECTO software on a centralized server will rely on Intel® Movidius™ Myriad™ X VPUs for fast, efficient inference and route alerts to human operators and SCADA-connected signage whenever an incident or hazard occurs.

Fast object recognition with the Intel Distribution of OpenVINO toolkit

The Intel Distribution of OpenVINO toolkit is an integral piece of the SPECTO software solution, enabling the system to run complex deep learning algorithms in parallel. When compared with generic algorithms, this parallel-processing deep learning model provides higher accuracy and more-reliable results with the ability to support 24 camera streams per server.[2] The toolkit also offers a number of different frameworks, enabling ISSD developers to choose specific object-recognition algorithms based on the target environment. Yüncü states, "Having several frameworks for deep learning makes it challenging to come up with a direct pipeline from development to deployment. The Intel Distribution of OpenVINO toolkit became the missing link to do so." By having a stable toolkit that met the needs for multiple scenarios, ISSD engineers could smooth out deployments while depending on their software to be performant.

Hardware tuned for AI vision workloads with Intel Movidius Myriad X VPUs

CPU-only configurations posed serious limitations to a successful deployment of the SPECTO solution. Yüncü explains, "Traditional architecture was not flexible enough; we had performance bottlenecks and scalability issues." To solve this problem, ISSD engineers made the critical decision to offload all vision processing onto discrete Intel Movidius Myriad X VPUs. With this setup, the central server running the SPECTO software directs all inference workloads to the VPUs, which can run vision workloads in parallel. The CPU simply controls resultant behaviors, such as making determinations about sending alerts to operators. By differentiating workloads in this manner, the server not only runs vision workloads faster, but also reduces the overall cost of deployments because fewer CPUs are needed.

SPECTO enabled by Intel® Movidius™ Myriad™ X VPUs delivers:[2]

Support for
4x
more camera streams

20%
reduced inference latency

30%
higher incident-
detection accuracy

25%
lower costs

Compared to previous CPU-only configurations.

## Key benefits of accelerated, automated incident detection

SPECTO deployments deliver success for traffic management applications, with an incident detection rate of 95 percent and a false alarm rate below 2 percent.[3] Transportation departments can rely on the system to augment their human operators in maintaining consistent monitoring of critical roadway infrastructure and to help spot and ameliorate potential hazards before they become bigger problems.

Cost-efficient deployments that scale
SPECTO can seamlessly ingest existing RTSP video streams, either from analog or digital CCTV cameras. This makes it easy for transportation departments to integrate a SPECTO server into existing camera infrastructure without having to rip and reinstall new camera systems. And the centralized server's AI vision capacity scales with the number of Intel Movidius Myriad X VPUs in the configuration. If a transportation department needs to cover more roadways, bridges, and tunnels, they can simply upgrade the number of VPUs and still benefit from fast alert and response times.

Simple, user-friendly, web-based UI
The SPECTO software provides a web browser–accessible dashboard for operators to access, where they can see a list of activated camera systems and locations. Users can choose which camera feed to focus on, and SPECTO will inform users if a camera feed is interrupted or disconnected. When an incident occurs, SPECTO will alert the operator with a pop-up window focused on the area of interest, along with a recorded video segment of the area, moments before the alert was prompted. Operators can see the events that led up to the alert. These features enable the human operators to do more, by directing their focus to key events rather than dividing an operator's attention across multiple cameras.
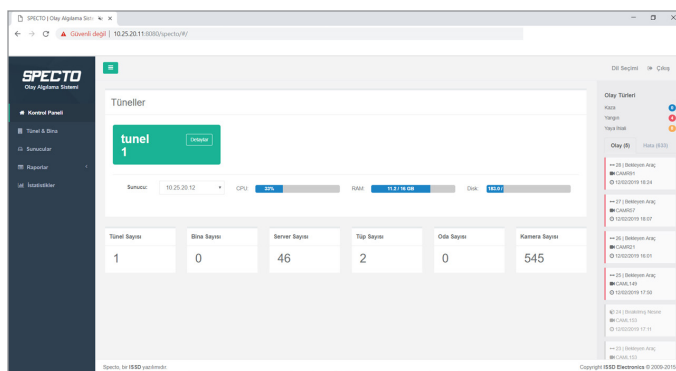
Figure 2. The SPECTO software provides a simple summary of locations and camera feeds.
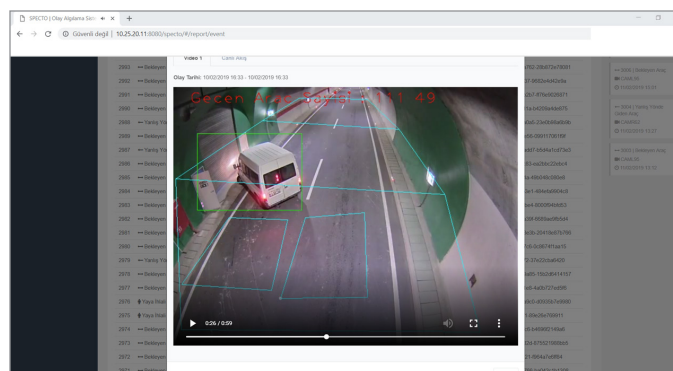
Figure 3. An incident window shows a brief recording leading up to the event that prompted the alert.

Smooth deployments, smooth rides, and safer streets

SPECTO offers a quick-to-deploy and cost-effective solution for traffic departments to monitor their most vulnerable roadways and infrastructure. Users benefit from precise incident detection, a simple UI that serves incident videos to operators, and the ability to integrate with SCADA systems to automatically alert other drivers on the roadway. And Intel® technologies at the heart of the solution deliver exceptional cost per performance for AI vision that helps reduce infrastructure needs. This combined solution helps improve the quality of life for drivers in cities, helps make streets safer, and extends the capabilities of traffic operators, all with minimal IT investments.

Learn more

SPECTO

The SPECTO solution enables traffic management offices to deploy cost-efficient AI vision and automated incident detection for their most critical bridge, tunnel, and highway infrastructure.

Learn more ›

Intel® Distribution of OpenVINO™ toolkit

This toolkit gives developers easy-to-access libraries, frameworks, and pretrained AI models to speed up AI vision developments for faster time to market.

Learn more ›

Intel Movidius Myriad X VPUs

The Intel Movidius Myriad X VPU delivers enhanced AI vision acceleration for edge-level devices and is programmable with the Intel Distribution of OpenVINO toolkit.

Learn more ›

About ISSD

Based in Turkey, ISSD focuses on research and development of intelligent and sustainable traffic management and automated incident detection solutions to improve public safety.

issd.com.tr

1. "ISSD SPECTO Incident Detection System," ISSD website, 2020. https://www.issd.com.tr/upload/Node/41759/files/Specto_White_Paper.pdf.
2. Source: Internal ISSD performance data. Configuration details for each Dell 740 server: 2x Intel® Xeon® Gold processor 5118, 7x Mustang V100 HDDL cards with 56x total Intel® Movidius® Myriad™ X 2485 VPUs; compared to 1x Dell 740 server with 2x Intel Xeon Gold processor 5118 and no additional VPUs.
3. "SPECTO™ Automated Tunnel Incident Detection System," ISSD website, 2020. https://www.issd.com.tr/en/23026/Automated-Tunnel-Incident-Detection-System.