

Solution White Paper

Intel® Core™ Processor

Intel® Video AI Box

Intel® Distribution of OpenVINO™ Toolkit



The Gamma Solution TITANUS EYEoT Smart Transportation Solution Based on Intel® Architecture Accelerates the Smart Transformation of Transportation Systems



"Increasingly heavy traffic flows highlight the necessity of smart transportation. We are working closely with partners such as Intel to provide high-performance, energy-efficient and reliable edge computing systems for transportation scenarios. We also provide computing power for new workloads such as AI video analytics. Through the application of these systems in a forward-looking digital transportation development model, we seek to improve transportation efficiency, reduce the cost of infrastructure construction, increase energy efficiency, and improve vehicle safety."

– WANYAT HON

Gamma Solution Managing Director

Overview

Smart transportation has shown promise as an effective method to reduce traffic congestion and traffic accidents, and improve the quality of life for citizens. Technologies such as computer vision and artificial intelligence (AI) can be used to process and analyze road video data, road condition data, road management data, operational data, passenger flow data, and more. Making full use of such data, smart transportation provides insights into the traffic situation along with real-time transportation management and scheduling. The integration of video and AI technology has been widely deployed in scenarios such as number plate and vehicle recognition, serving as a key direction for the evolution of smart transportation.

To further accelerate the implementation of smart transportation, Gamma Solution, a leading Malaysian distributor and provider of artificial intelligence security solutions, has launched the TITANUS EYEoT smart transportation solution based on Intel® architecture. Equipped with an Intel® Video AI Box powered by Intel® Core™ processors and Intel® architecture-based edge server, the solution integrates algorithms such as number plate and vehicle recognition, along with software applications such as identity verification, parking management, and visitor management. The solution is capable of efficiently processing and analyzing video data collected by front-end cameras to meet the requirements of scenarios such as smart parking and traffic behavior monitoring and analysis.

Background: AI Video Analytics Has Become a Key Requirement for the Smart Transformation of Transportation Systems

The global economy continues to grow and populations are migrating rapidly to urban areas (the urban population is expected to rise to 70%¹ of the global population by 2050). Day-to-day personal travels rapidly increases, which leads to pressure on transportation systems across the world. However, difficulties in realizing necessary solution upgrades and expansions in a timely manner have resulted in traffic congestion, traffic violations, environmental pollution, and other challenges.

The application of digital technologies is the key to improving the transportation capabilities of existing infrastructure. Research estimates that the global smart transportation market

¹ https://www.adlittle.com/sites/default/files/viewpoints/adl_the_future_of_urban_mobility_report.pdf

will grow to USD 190.6 billion by 2028, with a compound annual growth rate (CAGR) of 9.9% between 2022 and 2028.² In terms of regional markets, reports show that the smart solutions market for the U.S. public transportation system alone reached USD 11.3 billion in 2020. The Japanese and Canadian markets are expected to grow by 7% and 6% respectively between 2020 and 2027. The German market is expected to grow at a CAGR of around 6.1%.³

The digitization of transportation systems relies on the extensive analysis of video and other data. Transportation departments are actively deploying systems such as video-based road management, digital policing, and road condition management to gain critical insights from data and improve the efficiency and accuracy of management. Driven by the construction of traffic video management systems and the improvements to the resolution and other metrics of front-end cameras, video data has grown rapidly in recent years. There is high user demand for a smart video analytics solution that frees manpower from tedious tasks such as video analytics and retrieval. These solutions should also realize active monitoring to improve the efficiency of event response.

The Video + AI solution achieves processing and analysis of data collected by cameras and other devices through AI algorithms,

enabling the smart identification and tracking of specific targets (such as people, vehicles, and objects), along with instantaneous response and feedback to events. When compared with conventional solutions, the video + AI solution helps reduce manpower cost, accelerate event warning and scheduling, and provide useful data insights for decision-making. With strong market demands and broad application scenarios, the growth potential of smart video analytics is high. According to the Global AI Camera Market report, the size of the global AI camera market is expected to reach USD 5.6382 billion in 2022, and is expected to grow to USD 16.75 billion in 2026, representing a CAGR of 19.9%.⁴

At present, the video + AI solution has become a key part of the construction of smart transportation systems, while the deployment of video AI applications is driving the rapid growth of the smart transportation market. According to a report by MarketsandMarkets, the global smart transportation market is expected to grow from USD 94.5 billion in 2020 to USD 156.5 billion by the end of 2025, representing a CAGR of 10.6%.⁵

Despite their advantages, video + AI applications for smart transportation also face some common challenges.

Data path length and stability

Cloud deployment enables the intensive application of computing power resources, but is vulnerable to problems such as network interruptions and congestion, with relatively high latency. As technology advances, data processing is shifting from cloud and data center to the edge and endpoint. Edge and end devices need to be able to process data in a quick and reliable manner, so as to reduce the amount of data that needs to be uploaded to the server, lower bandwidth pressure, and reduce latency.

High computing power requirements of video AI applications

In order to meet the requirements of real-time management, video AI algorithm inference must be able to reach a certain number of frames per second (FPS) to ensure rapid response. An increasing number of algorithms are being integrated into the video AI systems. With improvements of video quality and increase in the number of cameras, the scale of video data that requires real-time analysis has exploded, posing significant challenges to AI computing power.

High variety of smart transportation scenarios

In smart transportation, video AI systems are deployed for safety management, parking management, emergency, and other area to meet the needs of applications such as smart parking and traffic behavior monitoring. This requires the integration of a wide range of algorithms. While these algorithms need to be trained for specific scenario requirements, they must also be adapted and optimized for software and hardware.

² https://www.reportlinker.com/p06283465/?utm_source=GNW

³ <https://www.marketresearch.com/Global-Industry-Analysts-v1039/Mass-Transit-Smart-Solutions-14406489/>

⁴ <https://www.globenewswire.com/news-release/2022/04/05/2416653/0/en/Global-AI-Surveillance-Camera-Market-Size-2022-2028-Growing-CAGR-of-19-9-New-Business-Opportunities-with-Covid-19-Effect-Growth-Drivers-Latest-Trends-Future-Demand-Analysis-by-Top-.html>

⁵ <https://www.marketsandmarkets.com/Market-Reports/smart-transportation-market-692.html>

Solution: Gamma Solution Smart Transportation Solution Based on Intel® Architecture

As a provider of AI security and management systems and IoT solutions, Gamma Solution is committed to innovation in AI, video management systems, AI access control, AI smart video analytics, and other sectors. Gamma Solution helps transportation departments construct smart transportation systems, improve road infrastructure, enhance transportation efficiency, and reduce the impact of traffic congestion, traffic violations, and environmental pollution.

Gamma Solution has launched the TITANUS EYEoT smart transportation solution to help users construct smart transportation application platforms that integrate software and hardware. Built on comprehensive and easy-to-integrate hardware and supporting technologies, TITANUS EYEoT is a scalable system with strong video analytics capabilities. The solution can be customized and seamlessly integrated with other security applications while achieving efficient operations and management.

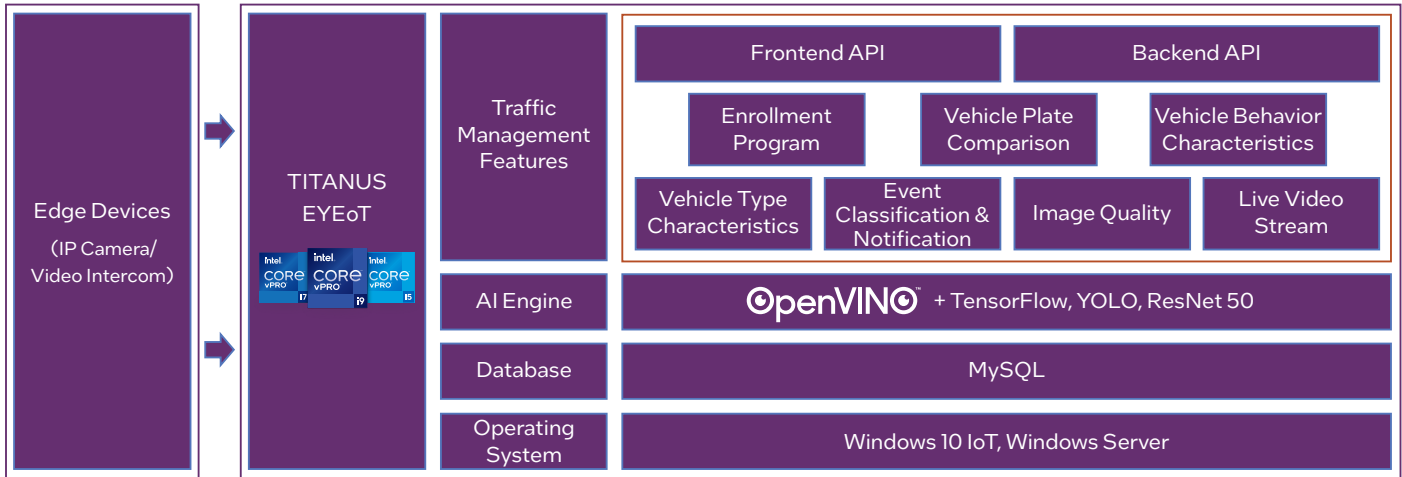


Figure 1. Architecture of the TITANUS EYEoT smart transportation solution

At hardware layer, the solution is built on the TITANUS EYEoT Lite X2/X5 at the edge. The TITANUS EYEoT Lite X2/X5 uses the Intel® Video AI Box as reference design, and adopts mature software and hardware components provided by the box. The Intel® Video AI Box adopts a high-performance, energy-efficient and cost-

effective software and hardware integration design to accelerate the development and implementation of edge AI applications.

The solution utilizes a TITANUS EYEoT Lite X2/X5 equipped with Intel® Core™ processors. Integrated with Intel® Iris® X^e graphics which has up to 96 execution units, Intel® Core™ processors enable INT8 low-precision inference with Intel® Deep Learning Boost (Intel® DL Boost), delivering outstanding AI inference performance. Intel® Iris® X^e graphics feature built-in media acceleration units such as up to two video decoder boxes to provide support for high-density video jobs. On this basis, the system is capable of smoothly running media codec and AI inference workloads without the need for discrete graphics cards. In addition to reducing hardware procurement costs, this also helps users control costs in terms of space, power consumption, and performance tuning.

Intel® Iris® X^e graphics allows the TITANUS EYEoT Lite X2/X5 to easily handle 8–32 megapixel video in a simultaneous manner⁷, providing support for CCTV live streaming and recording. Equipped with a high-performance CPU and integrated graphics processing unit (iGPU), the TITANUS EYEoT solution is capable of processing video decoding workloads efficiently, while still having enough resources to perform other tasks such as video analytics.



Figure 2. TITANUS EYEoT Lite X2/X5⁶

⁶ The Intel® IoT Market Ready Solutions (Intel® MRS) program accelerates adoption of IoT by vetting offers for completeness, repeatability, and scalability. Gamma Solution is Intel® MRS Provider.

⁷ Product specifications provided by Gamma Solutions. Intel does not control or audit third-party data. Please review the content, consult other sources, and independently confirm if the data provided is accurate.

The TITANUS EYEoT Lite X2/X5 efficiently integrates workloads such as video processing, AI inference, business applications and security, and provides scalable performance, easing workloads in edge device selection, integration, and optimization, and reducing infrastructure cost and complexity.

At the software layer, the TITANUS EYEoT smart transportation solution integrates video codec, video display, video stitching, video segmentation, video streaming, and AI inference in the TITANUS EYEoT Lite X2/X5. This allows for the efficient processing and analysis of traffic video data.

To help accelerate the development and time-to-market of traffic video processing and analytics applications, Gamma Solution utilizes Intel® video software tools and libraries (including the Intel® oneVPL, OpenVINO™ toolkit, Intel® System Studio, and OpenCV). Developed for Intel® chipsets, these tools and libraries provide Gamma Solution with optimized APIs and libraries, improving hardware performance and granting a competitive edge through Intel® technologies.

Specifically, the Intel® oneVPL (the successor to Intel® Media SDK) features an easy-to-use video processing SDK and full pipeline demos. Intel® oneVPL provides Gamma Solution with the ability to prototype, optimize, and productize media pipelines through a comprehensive and convenient API, accelerating the time-to-market and improving video playback, encoding, and media format conversion.

Gamma Solution has leveraged the OpenVINO™ toolkit to optimize the performance of AI inference workloads, which pose significant challenges to the TITANUS EYEoT solution. The OpenVINO™ toolkit

enables the rapid development of AI applications and solutions (including computer vision, and recommendation systems), helps improve performance, and supports the scaling of both computer vision and other workloads across Intel® hardware. The toolkit's "write once, run anywhere" feature allows for the execution of converted models across different Intel® hardware platforms, significantly simplifying the development and migration process.

As seen in the application process of the OpenVINO™ toolkit in the TITANUS EYEoT solution (Figure 3), trained models are optimized by the Model Optimizer (MO), and then converted into an intermediate representation (IR) for deployment on Intel® heterogeneous platforms such as CPUs, GPUs, VPUs, and FPGAs. This process accelerates model execution while simplifying deployment.

Gamma Solution also utilizes the Intel® VTune™ Profiler to profile workloads. The profiler is easy to use and capable of rapidly identifying workload performance bottlenecks for both CPUs and iGPUs. Thanks to Intel® VTune™ Profiler, Gamma Solution is able to identify bottlenecks in its solution and make the necessary optimizations to improve its performance.

Application Scenarios of the TITANUS EYEoT Smart Transportation Solution

Currently, the TITANUS EYEoT smart transportation solution has been successfully applied in scenarios such as smart parking and traffic behavior monitoring and analysis. The solution effectively meets the transportation management requirements of a diverse range of customers.

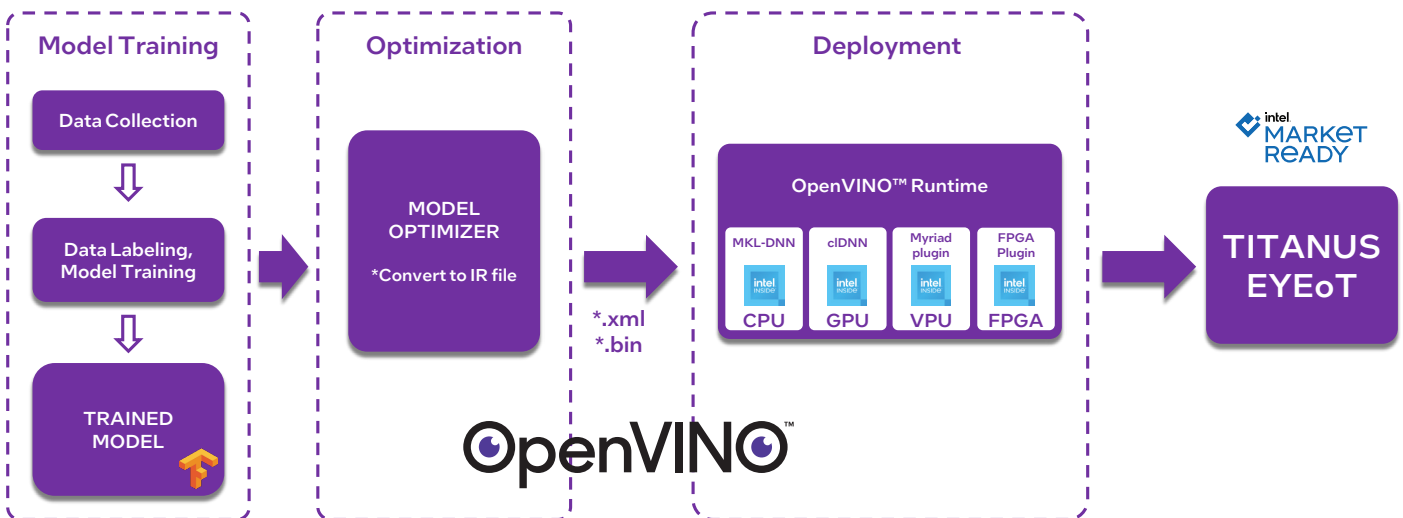


Figure 3. Application of the OpenVINO™ toolkit in the TITANUS EYEoT solution

Smart Parking System

Continuous urbanization has led to new challenges, primarily caused by a lack of supply in parking space resources, opaque data, and lack of management. For example, the large number of vehicles searching for parking spaces not only wastes the time of drivers, but may also result in road congestions, exacerbate traffic jams, road disputes, and even serious safety hazards. In busy parking lot scenarios, manual management cannot collect fees or identify violations such as identity theft in an effective manner. The inability to collect data such as parking space availability and the location of vacant parking spaces may also result in loss of revenue.

A report by Inrix Research found that drivers in the U.S. spent an average of 17 hours a year looking for parking spaces⁸, while

drivers in the UK spent an average of 44 hours a year⁹. The time spent is even longer in large cities such as New York and London. In this context, the implementation of smart parking management through video AI applications will be critical to the future development of parking lots.

The TITANUS EYEoT smart parking system is equipped with a deep learning number plate recognition algorithm capable of identifying the number plates of vehicles entering and exiting the parking lot. The system is connected with UHF RFID to detect the authorization status of vehicles and manage access. The system helps prevent fraud, data loss, and identity theft while reducing the workload of staff in vehicle authorization.

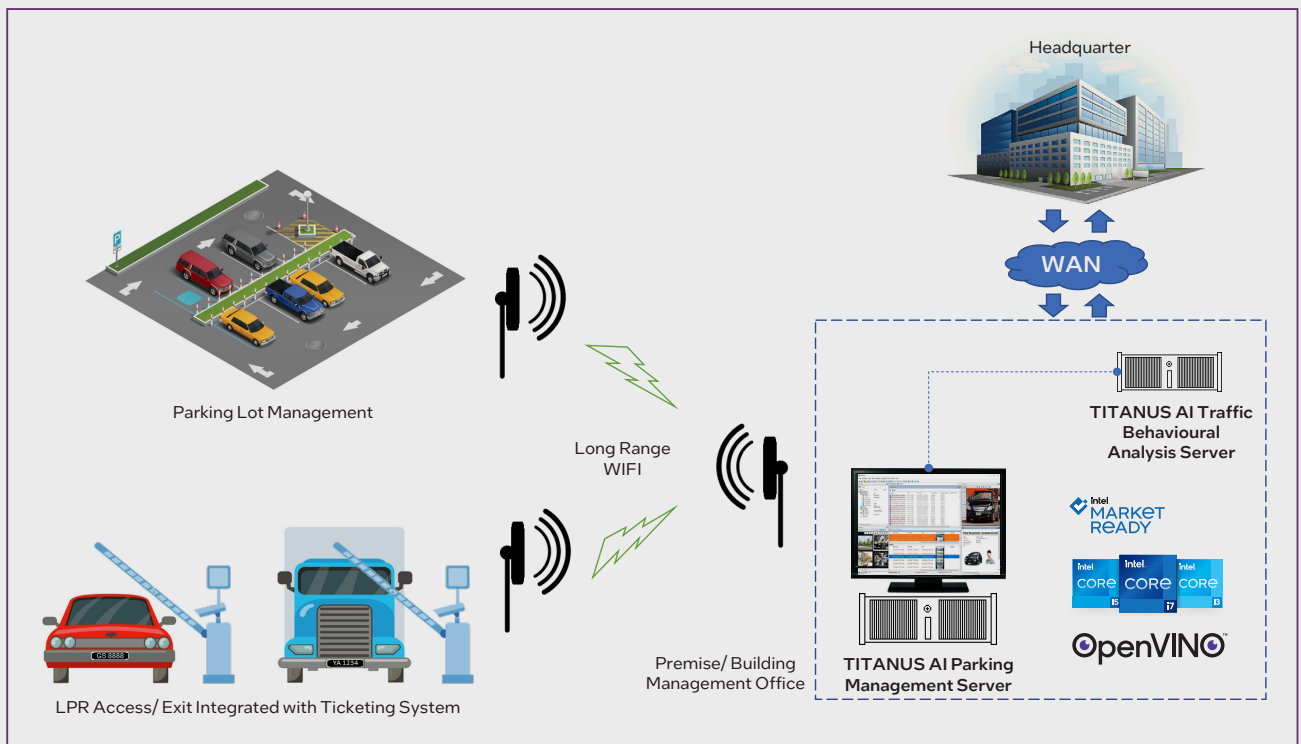


Figure 4. Architecture of the TITANUS EYEoT smart parking system

⁸ <https://inrix.com/press-releases/parking-pain-us/>

⁹ <https://inrix.com/press-releases/parking-pain-uk/>

The TITANUS EYEoT smart parking system can record the entry and exit time of each vehicle, display information of vacant parking spots, and provide user guidance. The system also helps drivers quickly locate their vehicles, while fee collection and automated parking authorization are realized through applications such as parking ticket management.

The TITANUS EYEoT smart parking system utilizes the TITANUS EYEoT Lite X2/X5 edge computing box. Equipped with 11th Gen Intel® Core™ i5/i7 processors, the TITANUS EYEoT Lite X2/X5 allows the solution to provide up to 8 video channels for data analysis and support up to 100,000 pieces of number plate recognition data¹⁰. The solution provides remote access and control functionality, and can be integrated with other third-party systems through SDK/API.

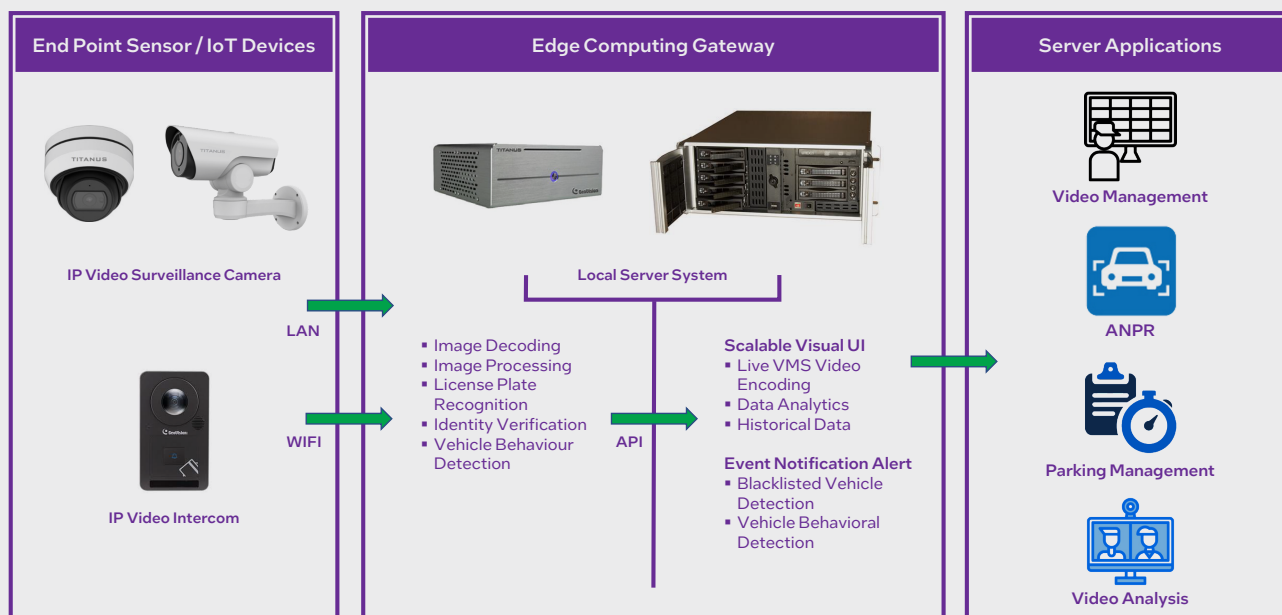


Figure 5. The TITANUS EYEoT smart parking system processes data the edge

Traffic Behavior Monitoring and Analysis System

With the rapid growth of traffic flow, traffic violations such as driving in the wrong direction, illegal parking, illegal stopping, and vehicle loitering have negatively impacted traffic law compliance and posed increasingly serious hazards. Conventional traffic behavior management relies on manual post-event verification, which is unable to respond to violations of traffic laws and regulations in a timely manner. This results in a lack of timeliness and accessibility in traffic management.

The TITANUS EYEoT smart traffic behavior monitoring and analysis system helps speed response to traffic events. The solution can access videos and images captured by cameras, and perform vehicle detection, vehicle amount recognition, vehicle type/color classification, and vehicle compliance recognition through algorithms such as vehicle recognition. This provides basic data analysis capabilities for smart transportation management.

¹⁰ Product specifications provided by Gamma Solutions. Intel does not control or audit third-party data. Please review the content, consult other sources, and independently confirm if the data provided is accurate.

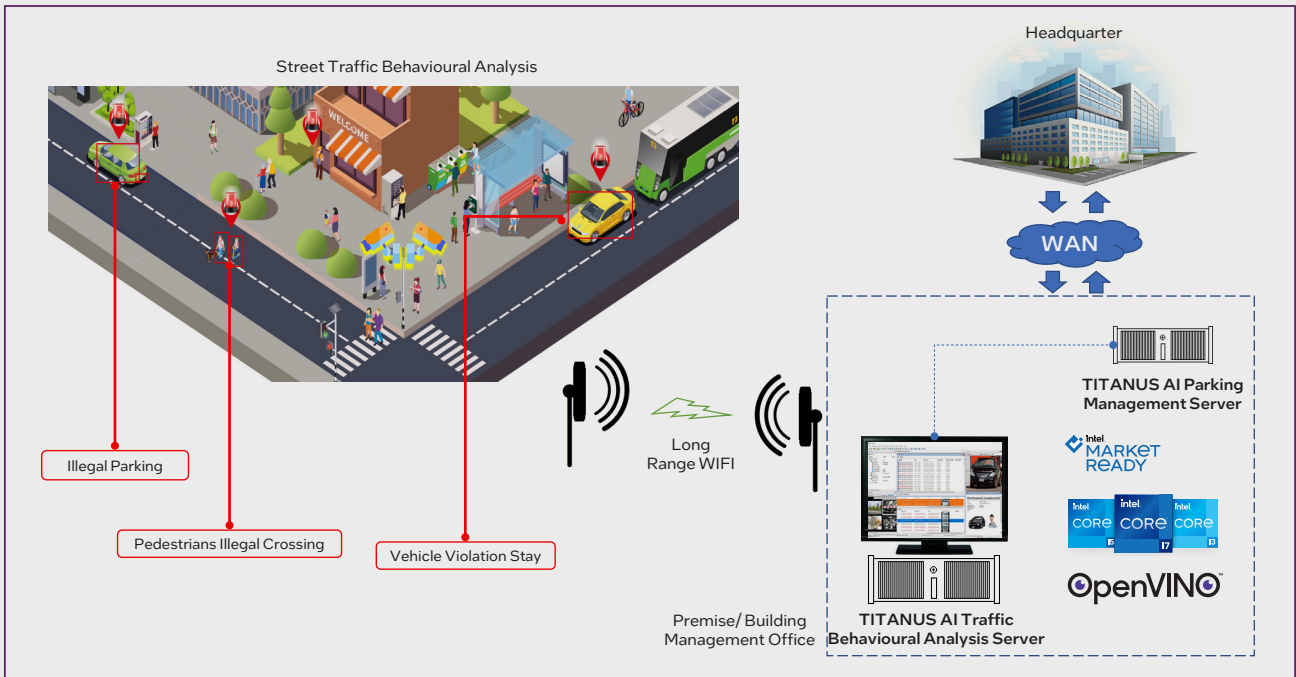


Figure 6. Architecture of the TITANUS EYEoT smart traffic behavior monitoring and analysis system

The TITANUS EYEoT smart traffic behavior monitoring and analysis system is based on the Intel® embedded platform, which is powered by 11th Gen Intel® Core™ i5/i7 processors and optimized with the OpenVINO™ toolkit. The TITANUS EYEoT smart traffic behavior monitoring and analysis system provides flexible storage capacity options, and comes equipped with 8¹¹ hot-swappable SATA mobile racks with support for upgrade

into a RAID 5 storage system. Depending on hard drive size, the system can store up to 112 TB¹² of logged event data and analyze a variety of traffic data.

Supported by Intel® products and technologies, the TITANUS EYEoT smart traffic behavior monitoring and analysis system provides up to 16¹³ video channels for data analysis, along with convenient remote access and control.

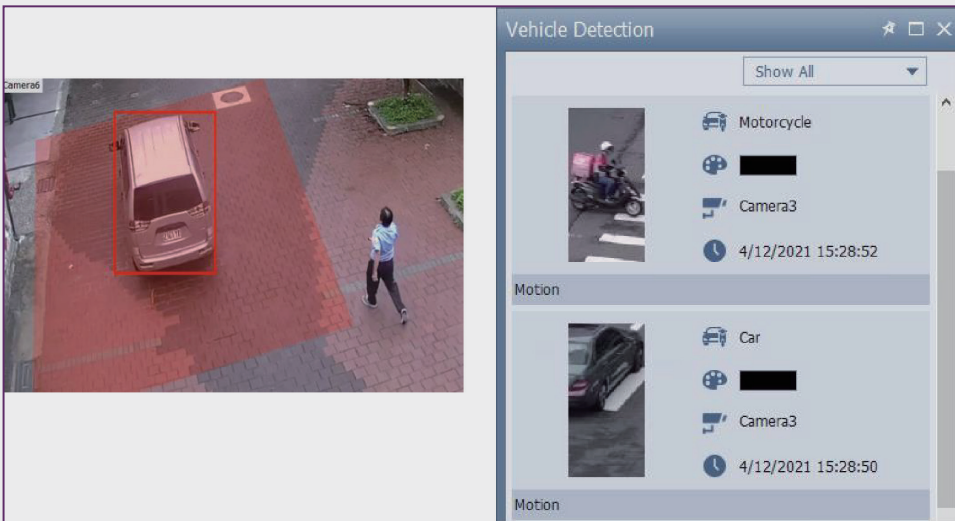


Figure 7. The TITANUS EYEoT smart traffic behavior monitoring and analysis system can identify a variety of traffic violations

^{11,12,13} Product specifications provided by Gamma Solutions. Intel does not control or audit third-party data. Please review the content, consult other sources, and independently confirm if the data provided is accurate.

Result: Facilitating the Smart Transformation of Transportation Systems

The TITANUS EYEoT smart transportation solution provides a variety of advantages to users.

Enhanced transportation management and resource allocation responsiveness

- Through the AI analysis of traffic video data, transportation departments can monitor traffic flow in real time and respond through automated evidence collection, alerts, and other methods.

Improved transportation management efficiency and reduced manpower costs

- Through automated smart traffic behavior analysis, the solution realizes rules-based transportation management, improves the data transparency of participating parties, and enables the full utilization of transportation resources. Through smart management, the solution also frees manpower from monotonous tasks, enabling the reassignment of personnel to more valuable work.

Improved stability and cost effectiveness

- Edge computing deployment reduces the delay of data processing and saves on investment in key resources such as bandwidth. In transportation scenarios with harsh deployment environments and high availability requirements, the edge solution protects against availability risks caused by factors such as network fluctuations while improving data security.

Enhanced performance

- Equipped with Intel® Core™ processors and OpenVINO™ toolkit, the solution meets the performance requirements of workloads such as AI, video decoding, transportation management, and fee collection. The solution removes the need for expensive procurement of dedicated accelerators, leading to higher cost performance.

The TITANUS EYEoT smart transportation solution has seen practical applications across a variety of scenarios, where it has helped users shorten the processing chain of traffic events, improve the immediacy of transportation management, and reduce manpower costs. In a new tourist town project in Malaysia, Gamma Solution helped users construct a smart transportation management system covering causeways and bridges, public transit terminals (pier/bus stations), parking lots, and all streets/roads. The system helped alleviate traffic congestion, reduced traffic violations, and improved the efficiency of the transportation network.

Outlook

The implementation of smart transportation is a long-term process. To accelerate this process, the transportation sector needs to further strengthen its application of technologies such as AI and computer vision, while accelerating investment in digital innovation. Methods that can be adopted include constructing a collaborative system from edge to cloud; reviewing and planning smart transportations in a comprehensive manner to prevent application and data islands; and consolidating multiple workloads into edge systems to increase efficiency and value while reducing total cost of ownership (TCO).

Intel will work with its ecosystem partners to provide refined solutions for a variety of smart transportation scenarios through high computing power, storage, and networking capabilities. From the edge to the cloud, Intel is committed to unlocking the value of data, helping the transportation department to provide quality services, reduce infrastructure costs, simplify integration, and drive improvements to transportation and logistics efficiency.

About Gamma Solution

Established in 2000, Gamma Solution is an Intel® based solution integrator and provider of artificial intelligence security solutions. Gamma Solution takes great pride in offering a variety of customized digital solutions and artificial intelligence that employ special applications specifically designed to optimize security and surveillance capabilities across Malaysia and South East Asia markets. With the advancement of Internet of Things (IoT), Gamma Solution will continue to leverage leading hardware and software products to deliver best-in-class digital artificial intelligence security solutions.

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