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Railway Solution

A Reliable Passenger Information Solution for Australian Intercity Railway Trains

Rolling Stock

Passenger Information Display System & Closed-Circuit Television (CCTV)

Project Introduction

Advancements in information and communications technology (ICT) have facilitated the introduction of network and digitized applications in the rail transit industry. For intercity railways, the establishment of passenger information systems (PIS) and CCTV image monitoring systems through ICT products provides passengers with sufficient ride information and a safe environments. The key to smooth system operation is the quality of selected hardware products.

System Requirements

Australia's New South Wales Railway (NSW TrainLink) is a passenger train operator on intercity lines. Recently, the NSW TrainLink operation company planned to replace older trains that had been in service for many years. They hoped to facilitate management and maintenance through new technology, while improving the service quality of intercity railway trains through instant information updates and real-time safety monitoring.

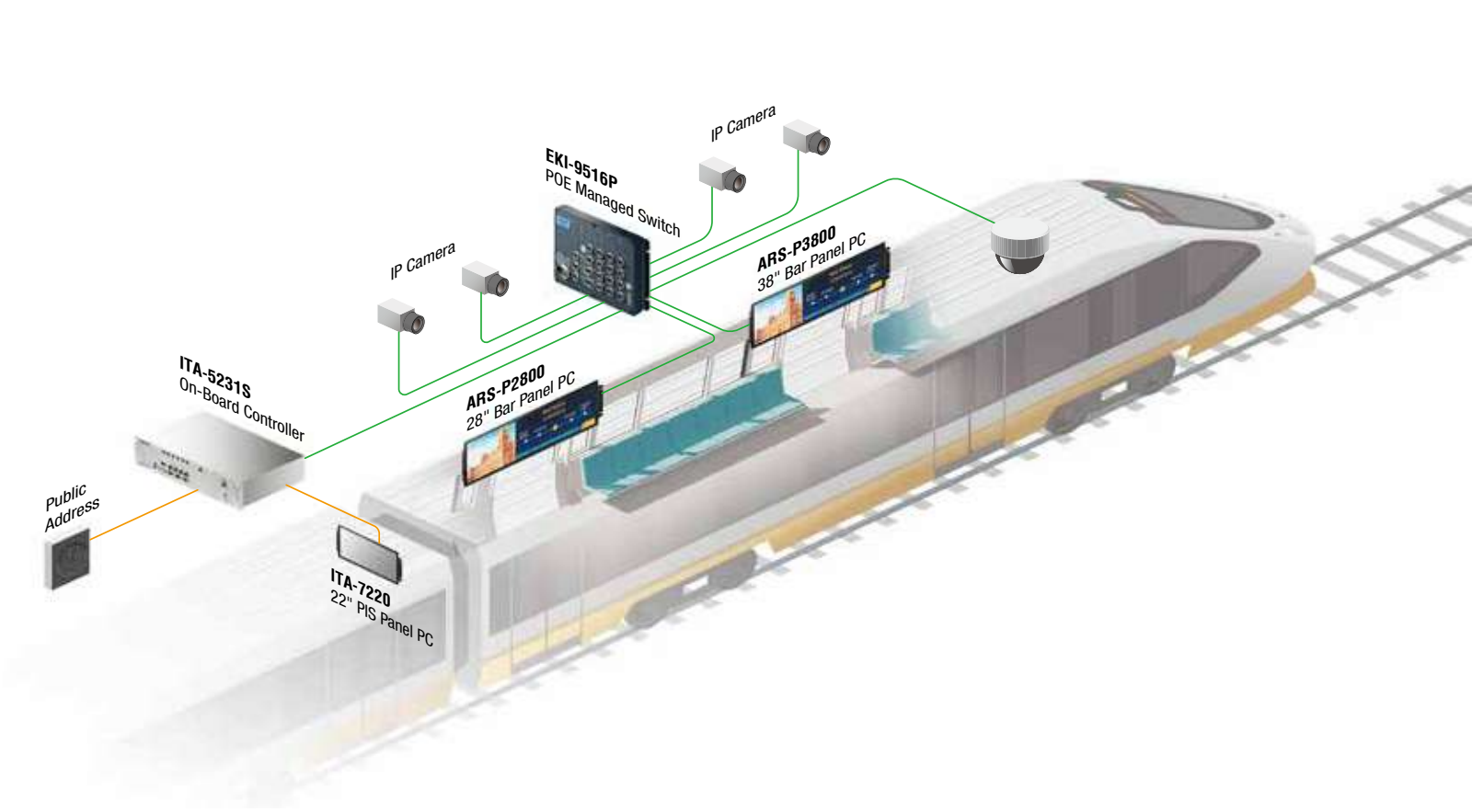
The required systems had to provide passengers with ride information and a route map, while enabling remote cabin monitoring. Furthermore, the hardware had to be internationally certified and compatible with the existing railway environment. Moreover, the on-board controllers had to be compact onboard computers installed in the vehicles body. They also needed to be rugged and durable for stable system operation. The switch had to be a network management product with PoE (Power over Ethernet) functionality to power multiple IPCams without extra power cabling.

System Overview

Advantech's solution, which combined the fanless system ITA-5231S with the managed Ethernet switch EKI-9516P, passed the anti-vibration, anti-shock, and working temperatures (-40 ~ 70 °C / -40 ~ 158 °F) requirements for the railway application standard EN 50155.

According to the body structure of the new train, two ITA-5831s and ITA-5231S were installed in each train. Two were responsible for the PIS, which was connected to the strip displays and adopted a dual-host automatic backup mechanism. When one of the hosts failed, the system automatically enabled the backup host-thereby ensuring the car screen consistently displayed the latest information. The ITA-5231S was used for the video surveillance system, which connected four IPCams via the EKI-9516P.

The project operated as follows: the server of the train control management system connected to the ITA-5831 via the network and then to each display. The route map and station information could be synchronized on all screens. The images taken IPCams were transmitted to the ITA-5231S of each train and stored on an SSD. Images were transmitted simultaneously so that the driver could monitor the cabins and ensure passenger safety.



ITA-5831 is the most critical product in the solution. This high-end processor control platform provides the ability to quickly process large amounts of data and features a small form factor ideal for applications with limited space. The PoE power supply provided by the management-type Ethernet switch (EKI-9516P) allowed the project to avoid laying individual power cables for each IPCam. This simplified the installation and deployment process while saving on construction and maintenance costs.

Conclusion

PIS and video surveillance systems are essential infrastructure for modern railway vehicles. Advantech's in-vehicle control solution passed strict quality control testing for performance, size, operating temperature, vibration, shock, and dust resistance enabling effective and reliable operation.

Why Advantech?

- The on-board controller is compact and features flexible IP expansion, enabling easy installation in small spaces
- PoE managed switch for railway applications uses M12 connectors to ensure tight, robust connections, and to guarantee reliable operation in harsh environments

Product Introduction

ITA-5231S

6th Gen Intel® Core™ i Processor Fanless System; EN 50155 Compliant for Railway Applications

EKI-9516P

16-port Managed PoE Switch with M12 Connectors that Meets EN 50155 and IP67 protection

ARS-P2800

EN 50155 Intel® Celeron™ J1900 28" Fanless Railway Bar-Type PanelPC

Railway Solution

Polish Intercity Railway Uses Advantech Solution to Build On-Board Infotainment System - Significantly Improving Traveller Experience

Rolling Stock

Infotainment System

Project Introduction

Railway on-board infotainment offers entertainment and relevant notifications including arrival information and travel routes. In-vehicle infotainment (IVI) systems also provide train operators with back-end management functions such as usage analysis, aggregate statistics, content delivery, and fleet monitoring. Without a powerful and complete on-board controller, handling such a quantity of video and data is difficult.

Advantech's fanless system and managed Ethernet switches are designed for railway applications. They are capable of processing large amounts of data in on-board infotainment systems and providing high-speed wireless network services. This high-performance solution ensures the smooth transmission of images, sound, data, and control commands. It also enables passengers to navigate online and access travel and safety information. Using this system, train operators can better understand passenger needs through statistical analysis.

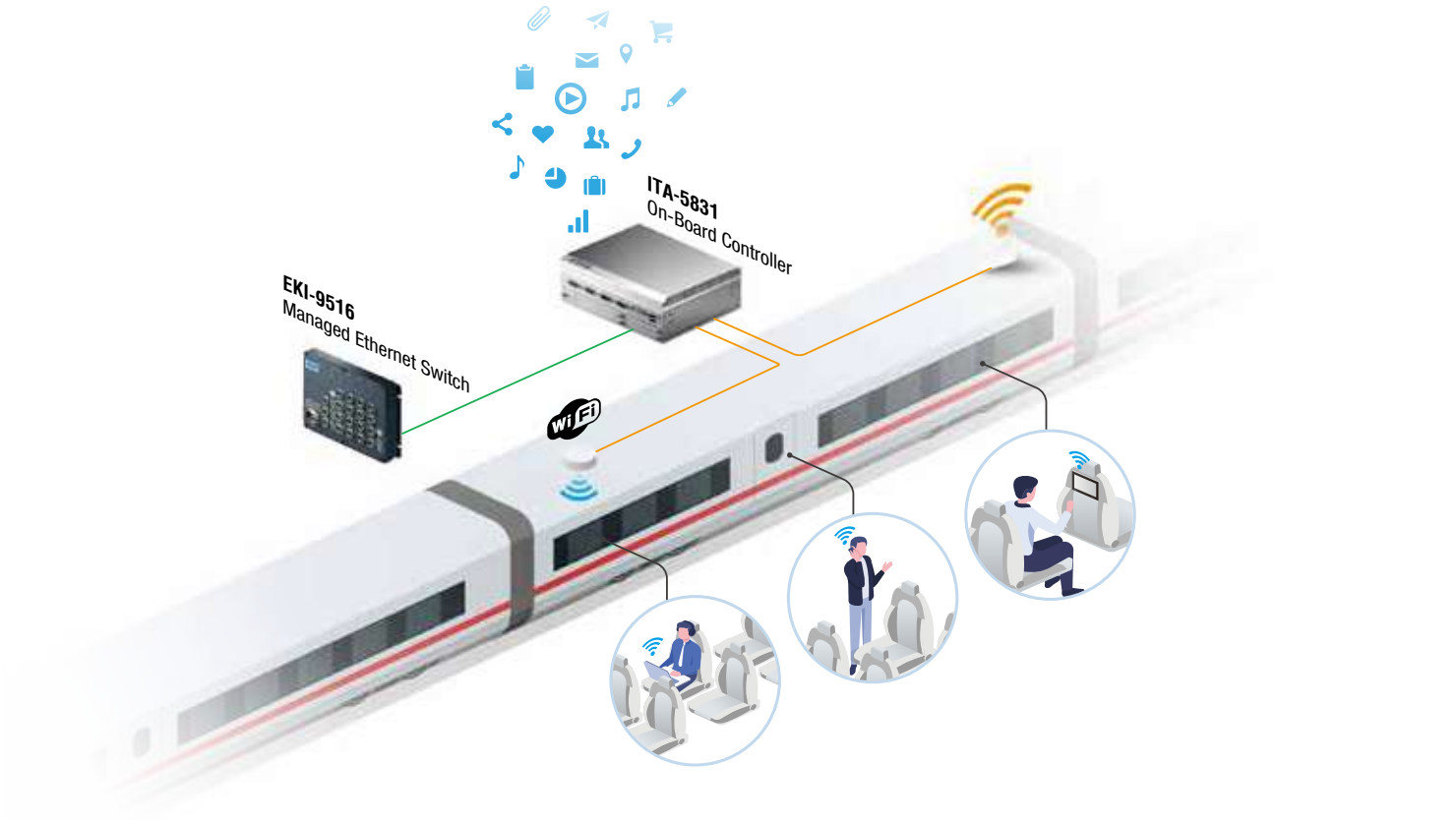
System Requirements

Trains are an important means of transportation for locals moving from city to city in Poland. The Polish intercity railway needed to introduce a system that included an array of services and management functions. These services included diverse audio and video entertainment content, train information, advertising, wireless internet access, network usage statistics and analysis, bandwidth allocation, and fleet management. In addition to developing software to build the on-board infotainment platform and creating wireless network connectivity, the embedded computers and network switches had to comply with EN 50155 specifications to ensure stable train operation. The embedded computer, key to the overall system, had to meet the following conditions — it needed to feature fanless operation, a wide operating temperature range, a simple dust proof design, and a having a small form factor for easy installation under the body of the front or rear of the car.

System Overview

Advantech provided two products, a fanless ITA-5831 and a managed Ethernet switch EKI-9516, to meet the multimedia services needs of this project. The ITA-5831, an on-board infotainment system and wireless network module developed by the system integrator and embedded in each car provided multimedia content and offered a Wi-Fi App for internet access through a connected EKI-9516.

The operating process of the entire system was as follows: content and information from the control center are received by ITA-5831 and then synchronized to each other via the EKI-9516. Passengers watch movies, listen to music, read e-books, or play online games through online apps via the touch panel on each seat or handheld device (including mobile phones and tablets). Train-related information, such as arrival information and travel routes, are broadcast to passengers through these devices.



Advantech provides a GPS module for each train to assist the traffic control center in train location monitoring, scheduling, and fleet management.

The system processes current wireless network usage through the ITA-5831. Administrators can adjust the network bandwidth at any time to ensure smooth network connections. The ITA-5831 provides internet and audiovisual content to passengers during the ride. When the service ends and the train returns to the depot, all data is downloaded to the control center for statistical analysis enabling the operator to discover new services or marketing solutions suitable for passengers. Furthermore, its built-in high-end Intel® processor and chipset can process data from a large amount of passengers. In addition, a variety of I/O interfaces and customized services meet the functional needs of varying cases. The ITA-5831, which supports general hard drives, SSD, and mSATA, can meet this project's storage needs for a large amount of audio and video data.

Conclusion

Advantech's products are capable of processing large amounts of data via on-board infotainment systems and providing high-speed wireless network services. This high-performance solution ensures smooth transmission while helping passengers use the internet and access travel and safety information.

Why Advantech?

- Advantech's EN 50155 compliant ITA-5831 offers high performance, multiple I/O configurations, and easy expansion
- The customized service meets the needs of different integration requirements

Product Introduction

ITA-5831

Fanless System with Built-in 6th Gen. Intel® Core™ i Processor that Meets EN 50155 Rail Application Standards

EKI-9516

16-port Managed Ethernet Switch with M12 Connectors that Meets EN 50155 and IP67 Protection

3.

Railway Solution

Train-to-Ground Wireless Communication Solution Enables IP-Based Networks for Remote Monitoring on the Boston Metro System

Rolling Stock

Train-to-Ground Communication

Project Introduction

With the advancement of network technology, greater numbers of rail trains are now network ready. In subway systems — a crucial part of urban transit-4G and WiFi networks are becoming prevalent as the preferred train — to-ground communication architecture. By setting up an IP network solution for train remote monitoring, traffic control centers and dispatching rooms can seamlessly communicate with train drivers while monitoring the train cabin through the NVR.

System Requirements

A world-renowned train manufacturer and solutions provider won the bid for the refurbishment of Boston Metro trains in the United States. This contract required the delivery of hundreds of next-generation IP trains. To balance the efficiency and safety of subway operation while providing a convenient and comfortable rider experiences, train manufacturers needed to meet more than 100 strict standards in the United States in terms of vehicle structure, safety control, and quality management.

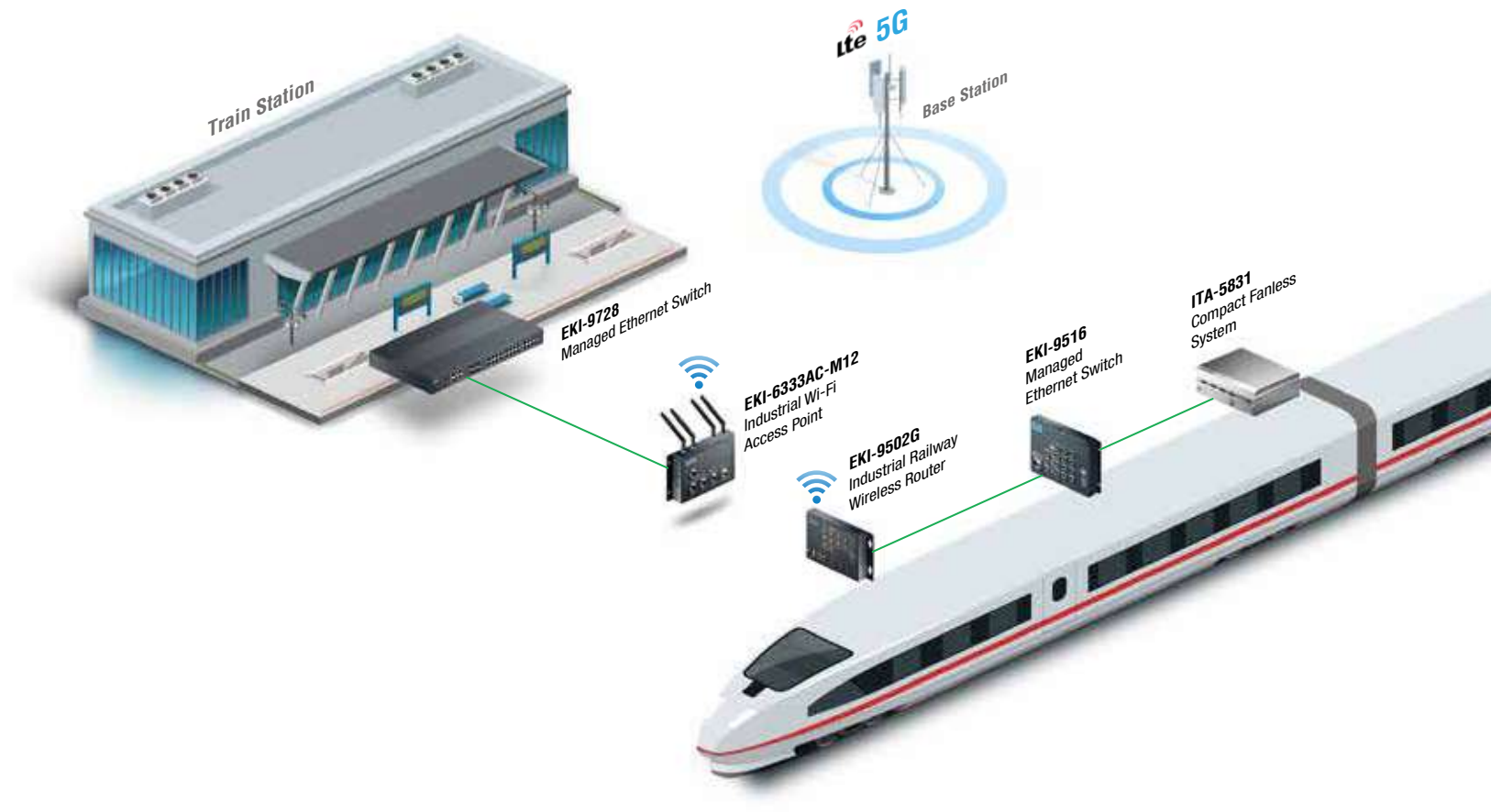
Additionally, the train manufacturer usually selected hardware products from different suppliers to complete the development of IP trains. However, this process created complications; there were often technical difficulties during the consolidation and testing process. Due to difficulties in sorting out responsibilities, the process cost the developer considerable time and effort in solving these problems.

System Overview

The train-to-ground wireless communication solution consisted of three products: The ITA-5831 fanless system for railway applications, the LTE router EKI-9502G installed in the locomotive, and the EKI-9516 managed Ethernet switch installed in each train carriage.

With this configuration, all images and data related to the train can be downloaded and uploaded via LTE or WiFi networks seamlessly. For downloads, the data for the traffic control center was transmitted to the EKI-9502G via the network, received by the ITA-5831, and then transmitted to the EKI-9516 and the passenger information display system (PIDS) of each car to show real-time passenger information. For uploads, the NVR of each car transmitted the data to the ITA-5831 via EKI. If an abnormal situation arose, the system actively uploaded the data to the traffic control center. The traffic control center for the dispatching room also actively accessed the video data through the network.

The three Advantech products were designed for railway applications and therefore had some equivalent specifications. For example, the products passed the EN 50155 international standard. The anti-vibration, anti-shock, and anti-interference capabilities were in line with railway applications: M12 connectors



were equipped to prevent loosening caused by vibrations from the moving train. This device also met compact size requirements, which saved on installation space and could be conveniently deployed in the train's compartment. The wide operating temperature range (-40 ~ 70 °C /-40 ~ 158 °F) ensured that the system functioned as normal in both high and low temperature environments. Operators didn't have to worry about Boston's low winter temperature affecting the system's operation, when a train headed back to the maintenance plant without central heating.

Conclusion

To further improve train safety monitoring, operational management efficiency, and passenger service quality, Advantech offers a comprehensive train-to-ground wireless communication solution, and provides professional assistance for secondary development of the project.

Why Advantech?

- The solution provides the ability to switch between different network services and carrier services to meet the needs of multi-network or multinational network applications
- Enables next generation IP-based trains to quickly develop and meet rigorous demands

Product Introduction

ITA-5831

Fanless System with Built-in 6th Gen. Intel® Core™ i Processor that Meets EN 50155 Rail Application Standards

EKI-9502G

M12 LTE Router with EN 50155 Rail Certification

EKI-9516

16-port Managed Ethernet Switch with M12 Connectors that Meets EN 50155 and IP67 Standards

Railway Solution

Compact On-Board Controller Ensures Stable ATO System Operation in Rome's Metro

Rolling Stock

Automatic Train Operation

Project Introduction

Urban transport-subways, trains, and high speed rail systems – are relatively closed mass systems featuring exclusive tracks that well suited for driverless applications. Due to improvements in related technologies, driverless systems have been introduced to rail transit aimed at addressing safety concerns caused by driver fatigue and operational errors. Doing so also increases operational efficiency while simultaneously improving transportation safety.

System Requirements

The electronic equipment in this system plays a key role in determining whether a driverless train operates smoothly during rail transit. Automatic Train Operation (ATO) is responsible for speed control, train headway adjustments, train stopping, and door opening/closing. Electronic equipment is used to collect data on train status. It also sends control commands from the traffic control center. The system will collect data from multiple devices and facilities on each train before integrating the data and transferring it to the train's TCMS. The TCMS will display the data on Driver Machine Interface and send it onwards to the traffic control center through specific tunnel GSM-R. Given these demands, entry-level on-board controllers that meet functional requirements within a tight budget are essential.

This product required an in-vehicle computer that passed rail specifications testing. It needed small form factor, expansible fieldbus communication interfaces, and an emergency communication tunnel. Furthermore, the solution had to be fanless, support broad operating temperatures, feature a simple dust-proof design, provide multiple I/O interfaces to ensure effective device data collection, and offer system function expansion for greater convenience.

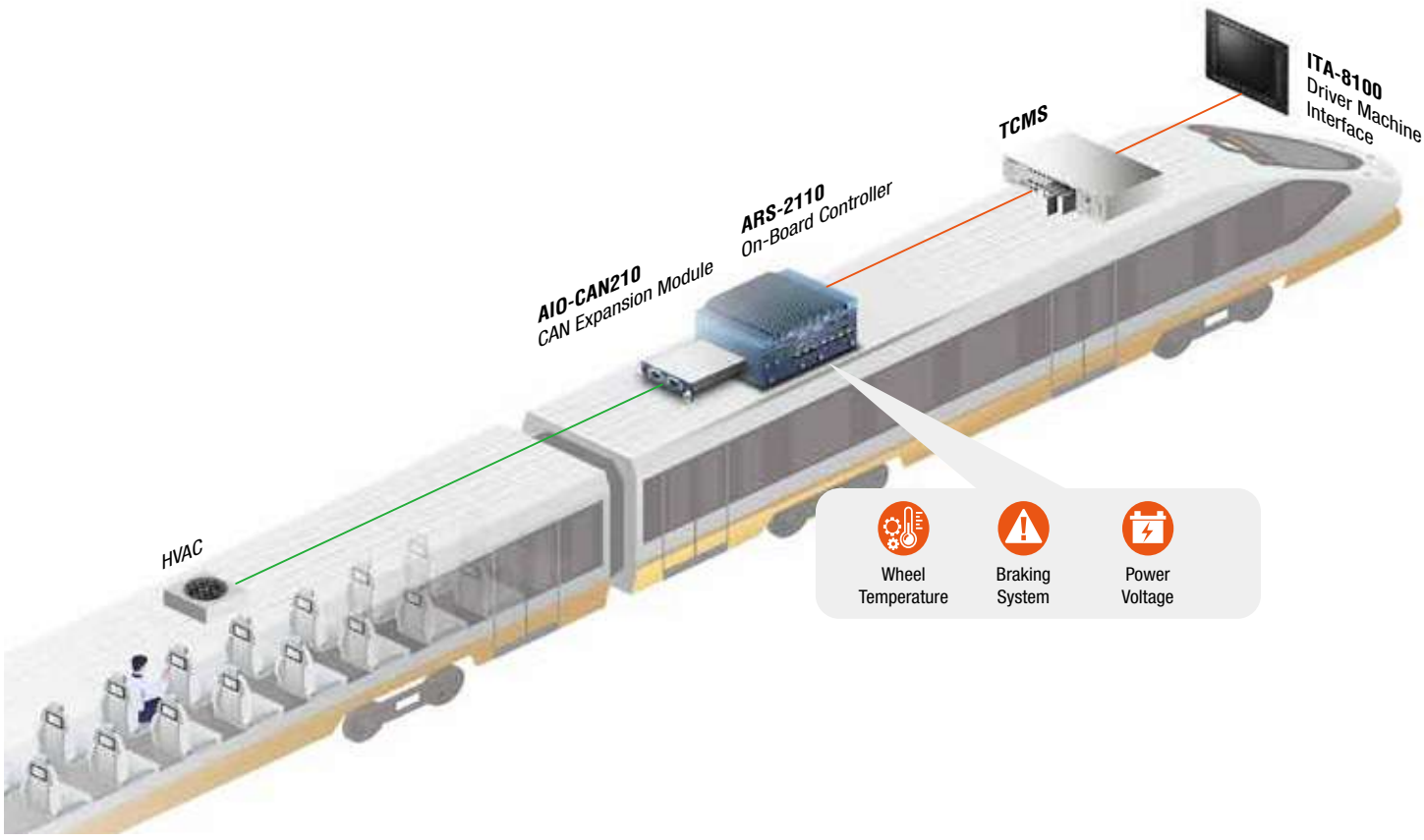
System Overview

Advantech provided an ARS-2110 fanless computer installed with an exclusive dual CAN port expansion module, as a cost effective in-vehicle controller for the ATO system of this project.

The ARS-2110 is installed below the system slot in the first and last train cars. The in-vehicle controller can receive sensor data through its CAN port and send data to the train's TCMS through its serial port, so that the train's status can be sent to the traffic control center.

The trains are equipped with two ARS-2110s with two CAN ports for backup hardware each, so they can switch to the backup computer or CAN bus if either computer or port malfunctions. This ensures malfunctions will not affect the system's control over the train's information and safety.

The ARS-2110 is an on-board compact size controller with



a fan-less wide temperature design that compiles with the EN 50155 international standard for railways. It meets Class S2/C1 requirements for railway standards and is able to endure a 10ms voltage interruption due to an unexpected power outage or power source change. It will not negatively affect system operations and data accuracy.

Furthermore, the trains are equipped with ITA-8100 providing real-time information and a touch panel design to train driver. Locomotive operators can improve safety control and optimize decision making based on the collection and analysis of all relevant data from TCMS.

Conclusion

Advantech's in-vehicle controller with modularized design complies with international rail application standards for ATO systems. It stratifies needs for different rail transit scenarios while also providing stability and reliability for driverless systems operating for long hours in harsh environments.

Why Advantech?

- ARS-2110 offers specific wireless communication GSM-R, and features a modularized design to satisfy the CAN bus requirements of this project
- ARS-2110 passed complete EN 50155 testing and meets Class S2/C1 requirements for railway standards

Product Introduction

ARS-2110

On-board Compact Small Form Factor Controller with Intel® Atom™ E3845 Processor and GSM-R that Meets EN 50155 Railway Standards

AIO-CAN210

Exclusive Dual CAN Port Expansion Module with Isolation Function for ARS-2110

ITA-8100

EN 50155 10.4" Fanless Railway Touch Panel PC with Intel® Atom™ x7-E3950 Processor

Railway Solution

Building a Railway Signaling System with Railway Compliant Computer Platform for the Ho Chi Minh City Metro System

Wayside Control

Railway Signaling and Interlocking System

Project Introduction

More than 80% of Ho Chi Minh City's residents use motorcycles as their primary means of transportation. Reliance on motor transport, coupled with a booming economy and an influx of foreign tourists, has significantly worsened traffic congestion throughout the city. To address this problem the Vietnamese government has begun implementing a traffic improvement plan centered on building a metro system in Ho Chi Minh City.

System Requirements

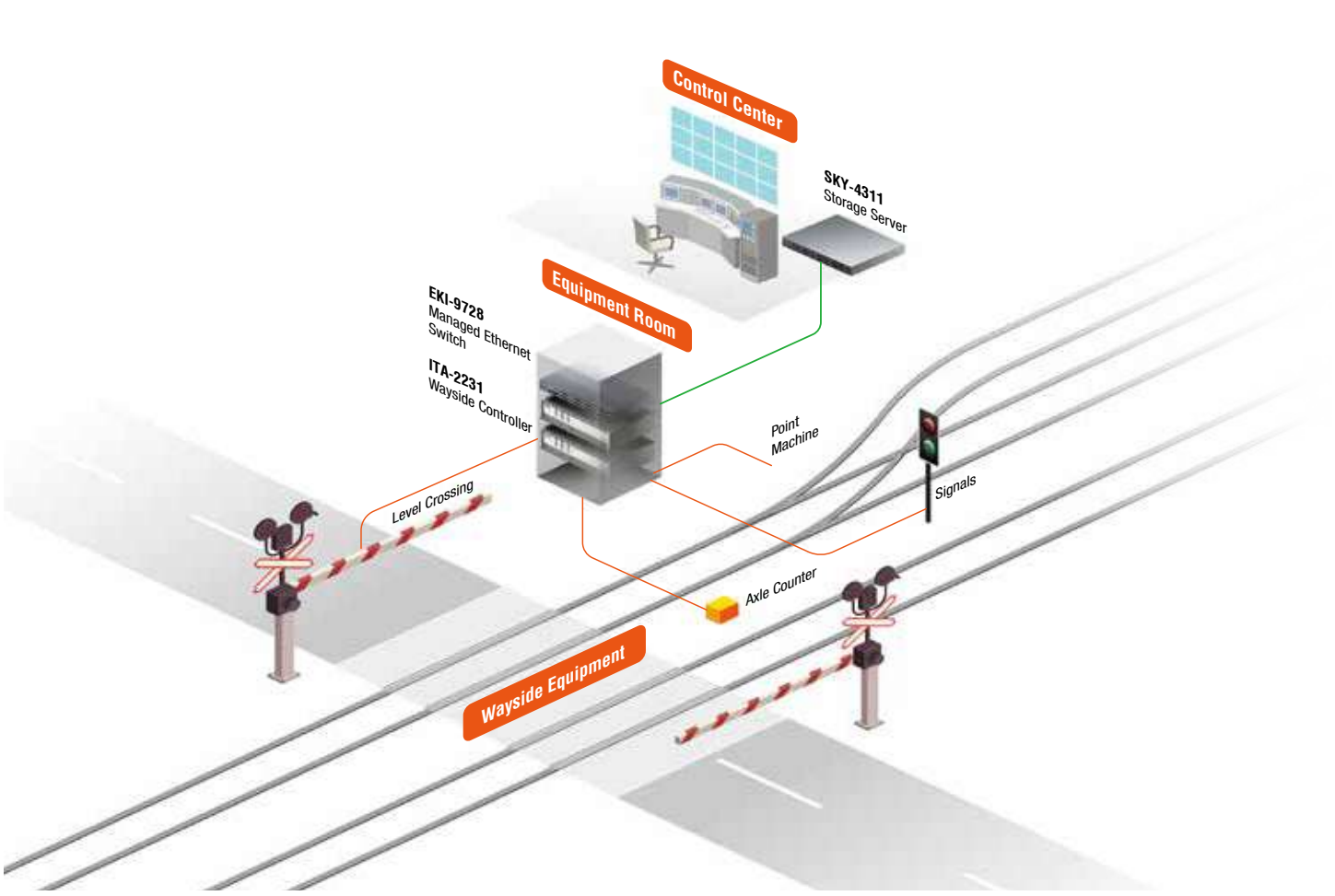
In order to balance operational efficiency and road safety, the Ho Chi Minh City MRT will use a moving block system. This system increases the traffic volume with the shortest headway by relying on the help of sophisticated technology products while establishing a safe distance between trains in order to prevent collision accidents.

The required system had to rely on the cooperation of various subsystems-the Automatic Train Supervision (ATS) and the Train Detection System (TDS) at the central control center, and the Automatic Train Protection (ATP), Automatic Train Operation (ATO), and Interlocking System on the wayside. The subsystems were connected to facilitate automatic train operation. Other MRT routes and extension lines will be open for bidding in the future. Therefore, this hardware required flexible expansion capabilities. Also, the continuous supply of hardware products and the provision of local after-sales services were key considerations

System Overview

Advantech helped the contractor in the construction of railway signaling system with a variety of products. These products included a server with a multi-core processors for control center's ATS and TDS; two industrial-grade managed switches, EKI-9728 and EKI-7712 for data transmission; and a dedicated track computer platform ITA-2231 for the ATP, ATO, Interlocking system, and data storage unit.

According to system requirements, each product was installed in different locations – such as the traffic control center, the wayside of large stations, and the wayside of interlocking systems. The operation process placed the ITA-2231 at the bottom layer. It was responsible for receiving the wayside signal. The data was transmitted to the top layer control center via the EKI switch. Simultaneously, the control center administrator was able to send instructions to related facilities. These instructions moved trains and controlled railway signaling. Administrators can receive timely assignment information guaranteeing track and rolling stock safety.



Advantech ITA-2231 passed the EN 50121-4 international standards test. Likewise, the built-in Intel® Core™ processor and Advantech's fanless wide temperature thermal design, and anti-electromagnetic interference capability aligned with railway application regulations. This device offered excellent performance in the harshest environments. The backup configuration and dual power modules eliminated users concerns about system interruption.

In addition to a variety of I/O interface types, the ITA-2231 also offered three ITA-EM slots that allowed users to expand the network, optical fiber, serial, and CAN connections based on different field requirements.

Conclusion

Advantech's EN 50121-4 railway application high-specification solution was compliant with rigorous professional standards for the project's railway signaling system. It not only offered sufficient computing performance for the heavy workload, but also provided a backup configuration to eliminate system interruptions.

Why Advantech?

- ITA-2231 is easy to scale out for different wayside equipment connection with redundant system in compact dimension
- Provided immediate local services across long product life cycles and effectively delivered supply-related materials

Product Introduction

ITA-2231

Fanless System with Built-in 6th Gen Intel® Core™ i Processor that Meets EN 50121-4 Wayside Application Standard

SKY-4311

1U Rackmount Dual Intel® Xeon® E5-2600 v3/v4 Storage Server

EKI-9728G

Industrial Rackmount L3 Managed Switch

Railway Solution

Nanjing Metro's Integrated Supervisory Control System

Station Management

Integrated Supervisory Control System

Project Introduction

With the maturity of automation integration technology, informatization-driven industrialization has become the direction of development. Most domestic urban rail transit lines have adopted the Integrated Supervisory Control System (ISCS) as the preferred method for monitoring and managing metro equipment in various cities. Therefore, a unified software and hardware platform is used to effectively integrate all subsystems to form a single comprehensive monitoring system.

System Requirements

The main requirements of the Nanjing Metro's comprehensive monitoring system include two parts: real-time centralized monitoring of electromechanical equipment, and coordinated interaction between various systems. On the one hand, through the comprehensive monitoring system, basic functions such as real-time centralized monitoring, control of equipment and clock information broadcasted by the passenger information system is realized. On the other hand, through the comprehensive monitoring system, advanced functions such as coordinated interaction between related systems and equipment under different conditions can also be achieved.

To these ends, the embedded computer had to meet specific requirements. It needed to be fanless, support wide operating temperatures, be expandable, feature port indicators, facilitate simple dust protection, and provide a variety of rich I/O interfaces to help the ISCS and other complex and diverse metro systems interface with each other.

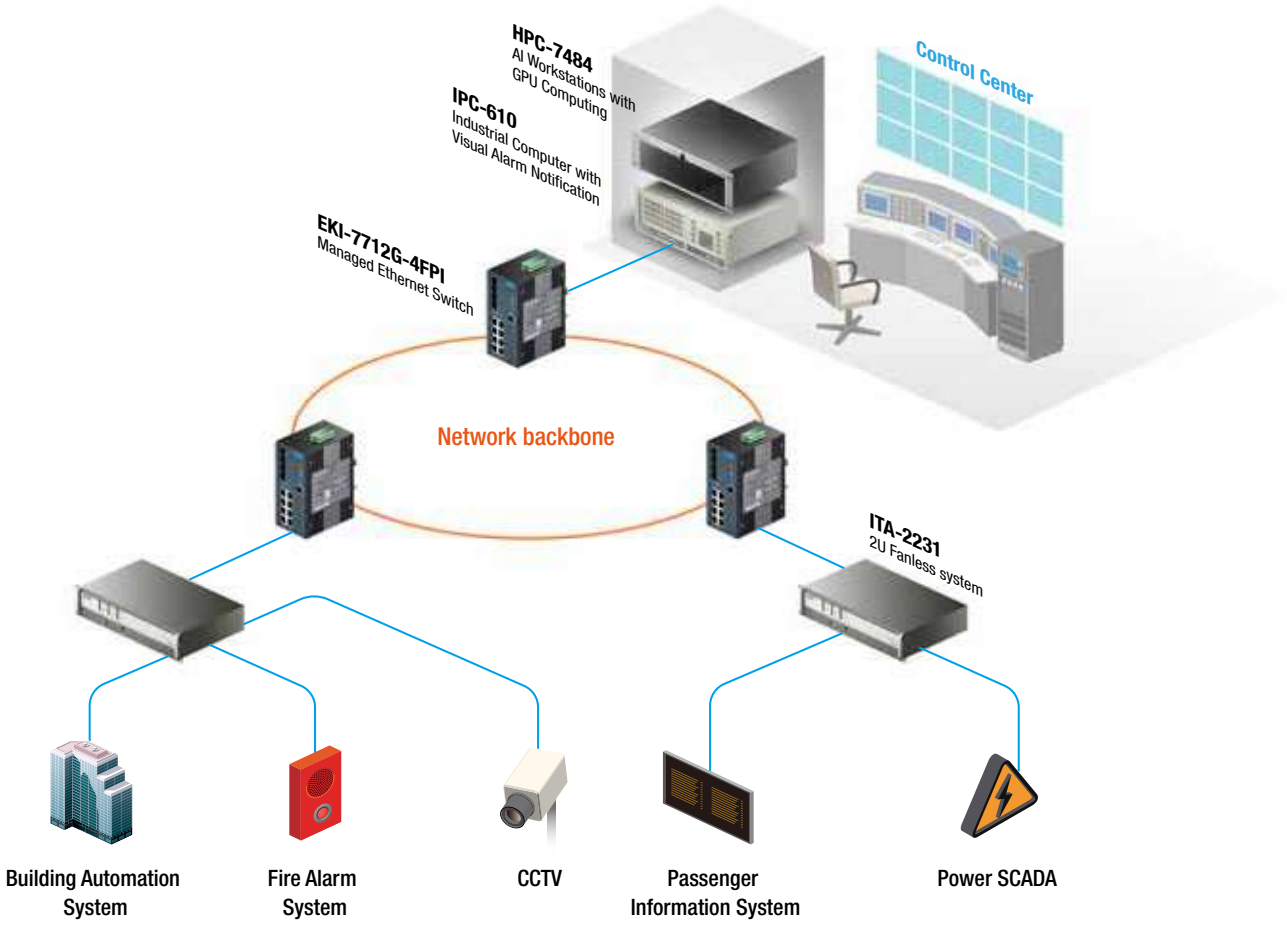
System Overview

Advantech provided two products; ITA-2231, a fanless expandable rackmount industrial computer; and EKI-7712, a managed Ethernet switch to provide diverse interfaces and high-speed connections. As the metro's ISCS must provide two-level management control mechanisms, ITA-2231 enabled comprehensive monitoring as a Front-End-Processor (FEP) and transcoders in different locations to provide sufficient and flexible interfaces. At the same time, EKI-7712 helped the ISCS to quickly and securely access the bearer network. Because it is a managed communication device, it can provide some security, isolation, and protection.

The entire system uses a two-layer management model for overall operations:

Layer 1: Central ISCS

The first layer includes redundant always-on servers, redundant historical servers, external disk arrays, tape drives, various dispatcher workstations (such as ESC, environmental, schedule, maintenance, and general), NMS workstations, event printers, report printers, color printers, redundant network switches with routing functionality, FEP (ITA-2231), large screen display



systems, and UPS. The OCC-configured network switch (EKI-7712) enables the interconnection of all OCC network resources. The number of ports on the switch and the choice of bandwidth should fully consider the requirements of ISCS and network communication equipment.

Layer 2: Station-Level ISCS

The second layer includes redundant real-time servers, station master workstations, redundant network switches, FEP (ITA-2231), IBP, and UPS. The DISCS is the same as the SISCS – both belong to the second layer but their configurations are different. The FEP handles all interfaces to the integrated system, and the data collected from the FEP is sent to a station server through the station switch.

Conclusion

Advantech's fanless rack-mounted industrial computer designed for railway applications can fully meet the application requirements of the ISCS. The industrial computer provides flexibility in the design of the board and supports boards with different interfaces to achieve customized needs in specific situations.

Why Advantech?

- Reliable product quality satisfies the supervision and management requirements of relevant departments to maintain the safety and reliability of subway operation
- Provides flexibility to achieve customized needs in specific situations

Product Introduction

ITA-2231

Fanless System with Built-in 6th Gen Intel® Core™ i Processor that Meets EN 50121-4 Wayside Application Standard

EKI-7712

8GE PoE and 4G SFP Managed Redundant Industrial PoE Switch

Railway Solution

AI Platform Incident Detector and Video Surveillance System

Station Management

AI Surveillance

Project Introduction

Safety for passengers in railway stations and on platforms is paramount. If an emergency occurs, station operators must be able to identify incidents immediately and deal with them quickly using cameras in the station. Traditional surveillance systems utilize video technology to automatically detect incidents on platforms and in stations. However, these traditional systems suffer from relatively low video quality and inaccurate analytics.

System Requirements

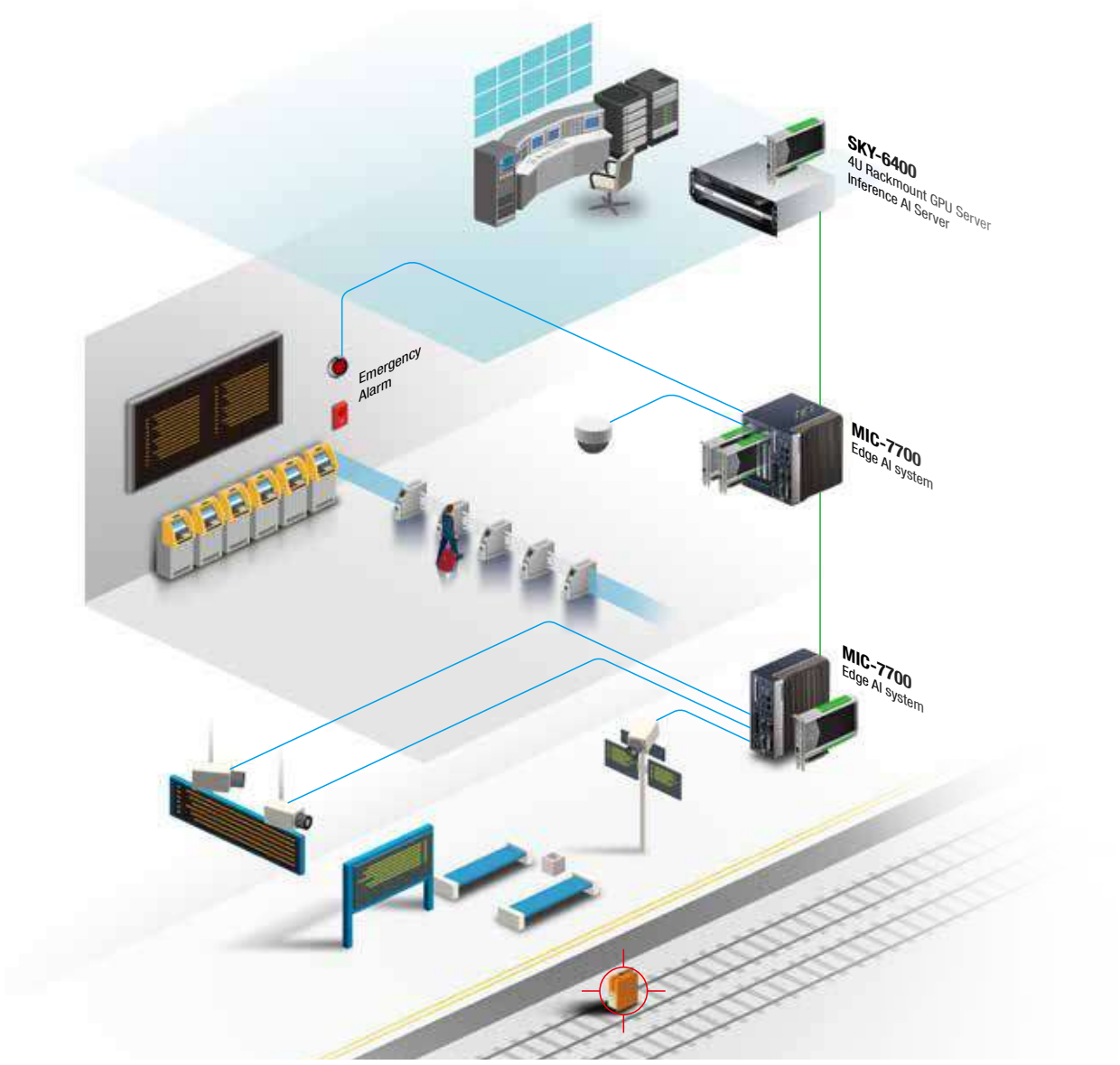
For this project, each camera conducts surveillance in its own preset monitoring to detect whether objects have fallen from the platform onto the train tracks. The system needed to support several cameras and be able to differentiate people from inanimate objects using AI inference, deep learning, and training methods. Powerful edge – based AI systems that leveraged GPU cards were deployed along the platform to detect incidents. Apart from the platform incident detection system, all cameras in the railway station are monitored by the AI inference system in the central control room. If an incident occurs in any security zone in the station, staff have to be able to control the situation quickly. In order to deal quickly with incidents, backend systems need to trigger alarm messages to notify station staff and even train drivers. The system also has to control related systems like railway signaling, and warning alarms with announcements to make the whole station aware of the incident.

System Overview

To solve the detection problems that typically occur in traditional video analytics, the AI video detector took advantage of deep learning technology to detect and recognize objects precisely. An edge AI system used a powerful NVIDIA® GPU to perform AI inference which required high computational complexity. In this case, MIC-7700 was used to grab four video streams from four IP cameras and recognize objects based on AI inference. MIC-7700 can work flexibly with MIC-7000 i-Modules series to support a variety of NVIDIA® GPU cards. Therefore, depending on requirements, railway operators can choose appropriate system combinations to meet their needs.

In the central control room, the AI inference server monitors all cameras in the station. To process this massive amount of information, multiple NVIDIA® GPU cards were integrated into a single server. The SKY-6400 4U rackmount server supports up to 6 x NVIDIA® GPU cards, including 4 x PCIe x16 double-deck cards, 1 x PCIe x8, and 1 x PCIe x4 used for heavy AI deep learning processing. Thermal issues are always a concern when GPU cards are used, so SKY-6000 features an industrial design and are NVQual certified to ensure AI computing performance. The solution provided a highly reliable AI video monitoring system for passenger and railway station safety.

- Full range of products from AI servers to edge AI systems
- Industrial edge AI systems support a variety of NVIDIA® GPU cards to perform AI inference
- NVQual certified GPU servers to support intensive deep learning computing



Conclusion

Safety for passengers in railway stations and on platforms is exceedingly important. To enable real-time video monitoring in the railway stations, Advantech offered an end-to-end AI solution that met station's specific application scenarios. Advantech's diverse selection of AI systems makes it easy for customers to develop their own edge solution.

Why Advantech?

- Significantly raises detection rate accuracy and greatly improves passenger safety
- NVQual certified SKY-6400 4U rackmount servers and MIC-7700 compact fanless system processes AI inference with the scalability needed to support multiple powerful NVIDIA® GPU cards on a a single server

Product Introduction

SKY-6400

4U Rackmount Dual Intel® Xeon®
Scalable GPU Server

MIC-7700

Compact Fanless System with
6th/7th Gen Intel® Core™ i CPU

Railway Solution

Advantech's Automatic Fare Collection System Makes Ticket Sales More Efficient in the Shanghai Metro

Station Management

Automated Fare Collection

Project Introduction

Numerous international rail transit systems have introduced automatic fare collection systems (AFC) to replace traditional manual ticketing and ticket checks. Ticket vending machines at the entrances of stations and automatic gate machines improve ticketing efficiency and eliminate waiting in line to buy tickets. They help passengers avoid inconveniences caused by missing trains due to long lines.

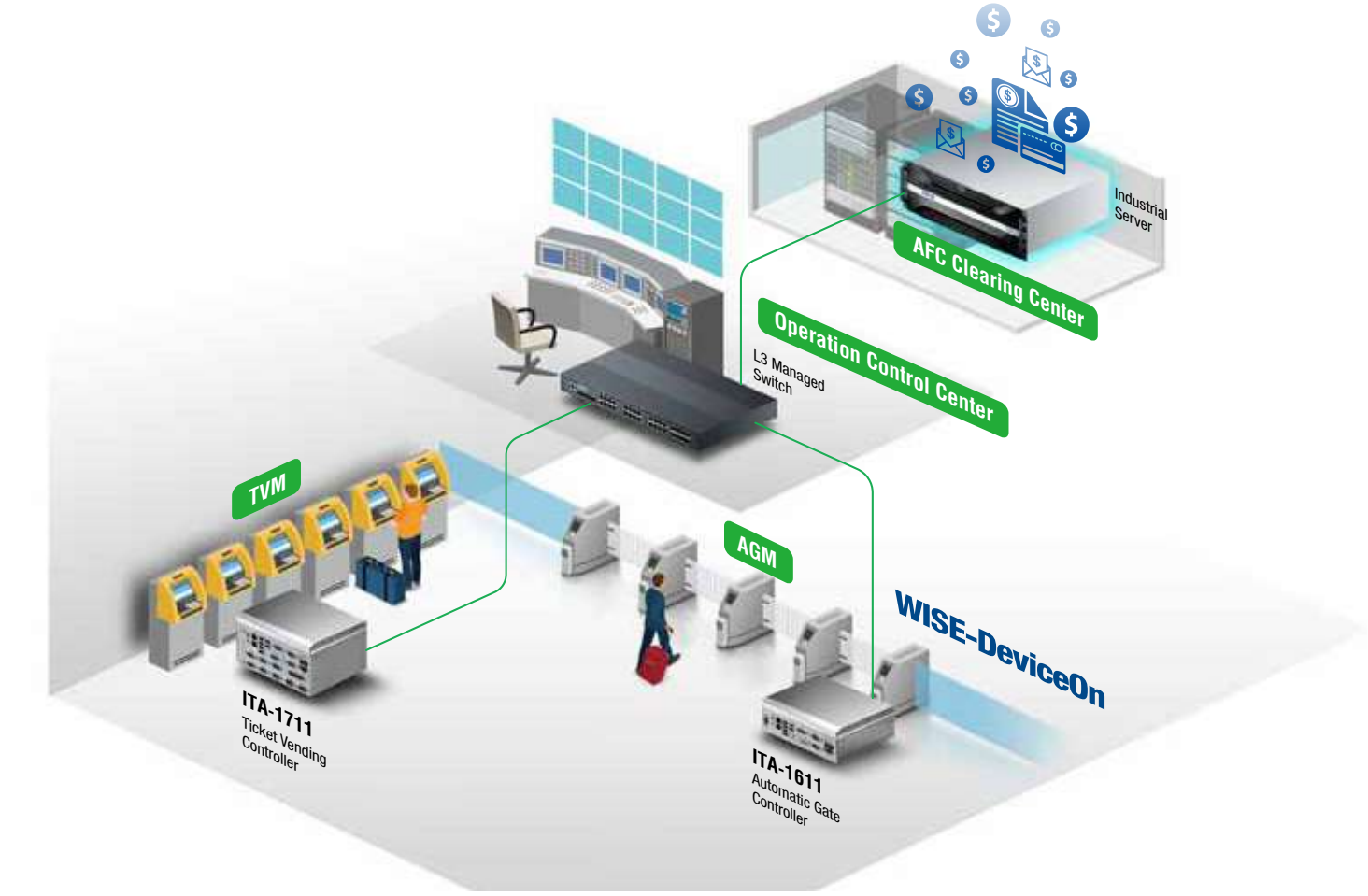
System Requirements

Automated fare collection (AFC) systems have become a basic requirement for urban rail transit systems. These systems are comprised of three parts: ticket vending machines (TVM), automatic gate machines (AGM), and the ticket checking machines (TCM). TVM, AGM, and TCM systems all require a central computer as a controller. This computer is responsible for quickly and accurately processing ticketing information and transmitting it to a background server via an Ethernet switch. Due to limited space in the machines and the high requirements on controller volume, heat, and power consumption, industrial computers are the natural choice. Because of the large data transmission throughput endured by Ethernet switches, commercial products cannot support the workloads found in stations in harsh environments. Therefore industrial-grade switches are used to ensure stability and long service lifetime in AFC systems.

System Overview

To meet the diverse application requirements of this AFC system, Advantech's AFC solution provided industrial-grade Ethernet switches and servers. Advantech also developed a dedicated controller, ITA-1711, which reduced system installation and maintenance costs. The ITA-1711 is a dedicated AFC machine designed for gate applications, meaning its ports are all on the same side and in a separate area. The areas for USB or COM ports make it installation and maintenance convenient for technicians. Moreover, considering various rail transit needs, Advantech also incorporated elements of flexibility and diversity in its product design to provide corresponding and customizable interfaces for different forms of ticketing.

Advantech's ITA-1711 model is adaptable to different displays, different payment methods, and different type of gates. The system integrator only needs to swap cards or slots to combine products to create bespoke systems. If the users has specific needs, Advantech also offers Design To Order Services (DTOS) to provide tailor-made systems, which would shorten the timeline from design to completion



Smart Management Reduces Station Operating Costs

In addition to hardware, Advantech has also introduced Advantech WISE-DeviceOn to enable remote monitoring and equipment management. For example, there are more than 100 AFC machines in the Shanghai Metro stations. During peak traffic hours, all TVMs are activated to quickly handle a large number of passengers. Conversely, during off-peak hours, managers can switch some machines to energy saving mode to manage resources. Furthermore, if equipment fails, managers can remotely see which parts are faulty, and determine weather to send an engineer out for repair. WISE-DeviceON not only saves system development time, but also helps station managers upgrade management processes and reduce operating costs.

Conclusion

From hardware to software, Advantech thinks about how to meet the needs of all members of the rail transit system, including system integrators, owners, and passengers. This spirit of "serving the entire value chain" is precisely why Advantech was able to penetrate China and the global AFC market.

Why Advantech?

- Advantech's AFC solution offers enhanced ticketing and ticket checking efficiency
- Ensuring all equipment can be remotely monitored and maintained
- Hardware with flexible design for different requirement and conditions

Product Introduction

ITA-1611

IIntel® Celeron™J1900 Fanless Compact System with Dual Gigabit Ethernet LAN and Dual Displays

ITA-1711

Intel® Celeron™J1900 Fanless Compact System with Multiple COM Ports and Dual Displays

WISE-DeviceOn

WISE-DeviceOn

IoT Device Management that Manages Connected Devices Remotely and Provides Centralized Management Features

Roadway Solution

Industrial Communication Solution Helps Build a Stable Data Network Infrastructure for Russia's Electronic Toll Collection System

Highway

Electronic Highway Toll Collection

Project Introduction

The Platon electronic toll collection (ETC) system was introduced to Russia's federal highways in November 2015. The ETC system was implemented to facilitate the collection of toll charges aimed at offsetting the damage that heavy trucks with a gross vehicle weight exceeding 12 tons inflict upon Russian's major highways.

System Requirements

The entire ETC system fulfills several tasks:

- Monitoring cargo car movement between cities
- Tracking cargo travel distances for toll collection purposes
- Combining data from weighing stations to check for road axis load limit violations
- Assisting police with license plate recognition and vehicle theft checks

Numerous devices and equipment (e.g., sensors, laser scanners, IP cameras, and RFID readers) had to be installed and connected to the servers; thus, an industrial Ethernet network was required. To aggregate and manage multiple data flows from different devices, the customer needed a reliable industrial managed switch that could operate in a wide temperature range.

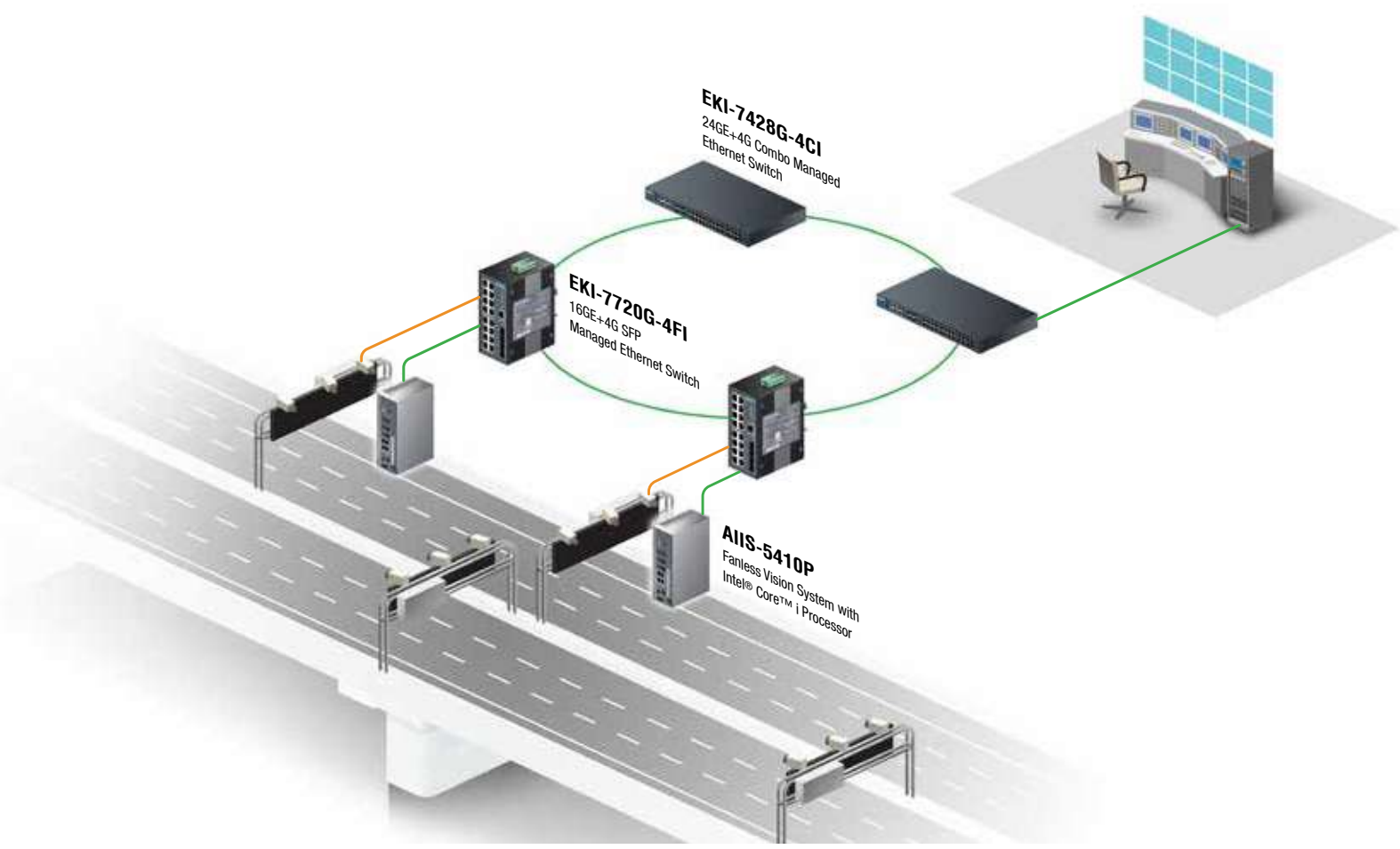
Moreover, the customer had a zero-tolerance policy for system downtime. Thus, the Russian Government would impose a large fine against the system integrator in the event of a system failure.

System Overview

To build a functioning ETC system that would fulfill the requirements of the Russian Government, numerous devices needed to be installed in the system.

- Each site consists of an overhead toll gantry with sensors and a control box installed on it
- Each lane has a video camera installed for license plate recognition
- Laser scanners are installed to acquire information on passing vehicles (e.g., dimensions and weight) to ensure that license plates are not swapped to avoid toll payment, and to obtain data from RFID readers fitted to the car windshields in order to process toll payments
- RFID readers are fixed to car windshields to provide GPS tracking between checkpoints and to spool data to the main system when passing under a read station

After testing different products, Advantech's industrial managed switches (EKI-7428G-4CI & EKI-7720G-4FI) and fanless vision system (AIIS-5410P) were adopted for the entire ETC project. These were selected because of their excellent redundancy capability and reliability. The quality of these products helps prevent system downtime and ensures the highest system performance at all times.



Furthermore, Advantech offers a compatible integration of vision system industrial PCs and network switches. At each checkpoint site, AIIS-5410P systems are used to host several Linux virtual machines that serve multiple functions such as license plate recognition and car profile scanning/recognition. Meanwhile, EKI-7428G-4CI managed switches are utilized to aggregate data flows from various devices, including the vision system industrial PCs, IP cameras, and RFID readers, and form an X-Ring Pro topology, Advantech's self-developed data redundancy technology, with EKI-7720G-4FI managed switches to further ensure network stability. Finally, EKI-7720G-4FI managed switches pass data to the control room for monitoring and advanced analysis.

Conclusion

Using Advantech's reliable products and prompt support from the technical team, the system integrator secured this project by building robust and stable data network infrastructure meeting the stringent requirements of Russia's ETC system.

Why Advantech?

- Offers a compatible integration of vision system industrial PCs and network switches
- Advantech's X-Ring Pro technology for a redundant Ethernet network with an ultra-high speed recovery time of less than 20 ms ensures safe data transmission and to eliminate system downtown

Product Introduction

EKI-7428G-4CI
24GE+4G Combo Managed
Ethernet Switch

EKI-7720G-4FI
16GE+4G SFP Managed
Ethernet Switch

AIIS-5410P
Fanless Vision System with Intel® Core™
i Processor, 4-Channel GigE PoE Camera
Interface, and PCIe Slot

Roadway Solution

Realizing a Centralized Monitoring and Management Solution for Expressways in China

Highway

Tunnel Management

Project Introduction

Expressways are critically important transportation infrastructure. Recently, local and national level governments have introduced advanced technologies to improve the efficiency of highway transportation systems and reduce congestion. For system integration vendors, highways with many subsystems present a complex challenge. Developing hardware and software products that deliver the types of systems required by customers often proves time and labor intensive.

System Requirements

The Langfang-Zhuozhou Expressway in Hebei Province, completed in 2008, has been in operation for more than 10 years. As a result, the functions of the existing system have long been unable to meet current application requirements and new regulations. Insufficient network bandwidth affects the performance of the system, the lack of a backup mechanism puts the network at high risk of interruption, manual fee collection leads to vehicles waiting in line to pay, and insufficient CCTV resolution makes it difficult to analyze traffic incidents. The management unit was eager to solve all these problems.

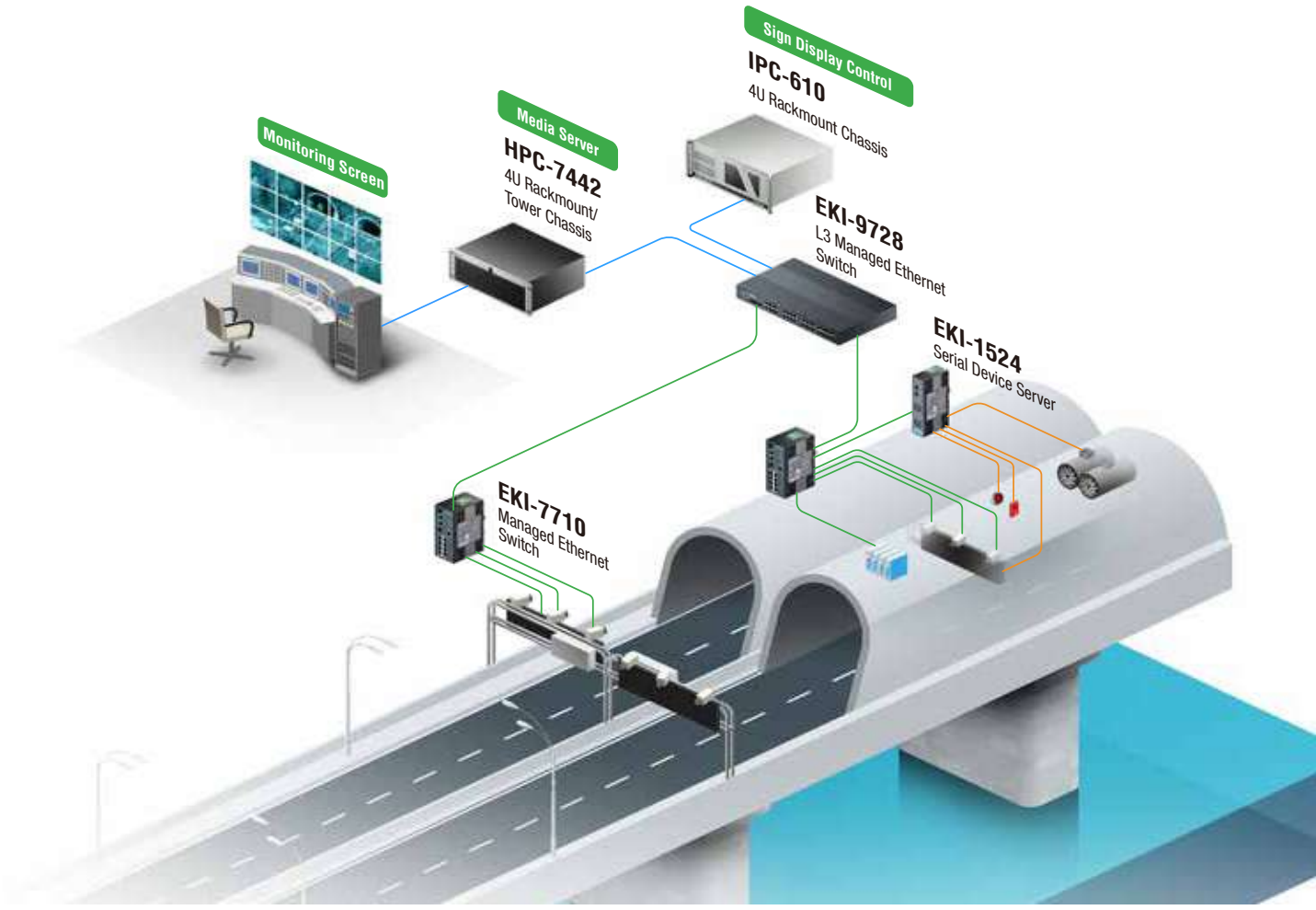
The old system was decentralized and operated independently. This was not conducive to monitoring and management, and raised maintenance costs for the Langfang-Zhuozhou Expressway. The management unit decided to introduce high-resolution surveillance cameras, a contactless toll collection system, a Gigabit Ethernet system, and a traffic incident analysis system to build a new centralized monitoring and management operation model.

System Overview

The system integrator (SI) that undertook this project needed to develop various systems in response to the monitoring needs of different application fields: operation control centers, roads, tunnels, toll stations, and rest areas. It was necessary to purchase a variety of hardware and software. To complete the project quickly, the contractor decided to choose a single supplier to provide the required products, including the software development platform, servers, industrial computers, network switches, and serial device servers. Doing so reduced integration complexity and allowed the SI to focus on meeting client-side application requirements.

In this case, Advantech's one-stop solution was composed of the WISE-PaaS Industrial IoT cloud platform, HPC-7442 server-grade hardware platform, IPC-610 rugged industrial computer, EKI-9728 L3 managed switch, EKI-7710 managed Ethernet switch, and the EKI-1524 four-port serial device server. This solution met the diverse and complicated application needs of the project.

On the software side, the SI needed to develop five sets of



management systems for the traffic control center and tunnels along the Langfang-Zhuozhou Expressway. At the same time, they integrated existing systems to build a unified management and monitoring platform. WISE-PaaS allowed the developers to easily import device information and collect data in the system. Advantech provided a dashboard that helped designers visualize data and monitor the network equipment and connections of each port, making field equipment maintenance very convenient.

Conclusion

Advantech's comprehensive product line allows system integrators to select products tailored to individual projects. Integrators enjoy a one-stop solution that reduces integration risks, saves development costs, and speeds up hardware and software configuration.

Why Advantech?

- Offers a complete solution for transforming and upgrading highways and tunnels
- Builds a centralized management system that effectively monitors remote devices
- The redundant system architecture prevents equipment and fiber failures for greatly improved network reliability

Product Introduction

WISE-PaaS
Industrial Internet of Things Cloud Platform

HPC-7442
4U Rackmount/Tower Chassis for EATX/ATX Motherboard

IPC-610
4U Rackmount Chassis with Visual Alarm Notification

EKI-9728G-4X8CI
Industrial Rackmount L3 Managed Switch with AC/DC

EKI-7710G-2CI
8 Gigabit + 2 Gigabit Combo Managed Switch with IXM, Extreme Temperature -40 ~ 75 °C(-40 ~ 167 °F)

EKI-1524
4-Port Serial Device Server with Wide-Operation Temp. Range and Isolation

11.

Roadway Solution

Building a Cloud-Connected Smart Parking Lot with Solution Ready Packages for a Boutique Department Store in Taipei's Xinyi District

Smart Parking

Parking Lot Management

Project Introduction

Driven by the trend towards IoT and cloud services, parking lots are changing from manual systems to smart remote monitoring and management. In doing so, operators are hoping to solve problems of inefficiency and parking fee loopholes. Guidance and car-searching technology has increased the fluidity of parking spaces, while intelligent lighting makes better use of energy.

System Requirements

A complete cloud-based connected smart parking lot management system must include several things: the underlying hardware devices, the middle-layer cloud platform responsible for the connection between the cloud platforms, and bottom layers, and the upper-layer SaaS application. Development and integration work by system integrators requires a significant amount of time and effort. Coupled with the pressure to meet the needs of different cases and ensure the stable operation of the system, project completion often faces severe delays that can adversely affect the overall competitiveness of a company.

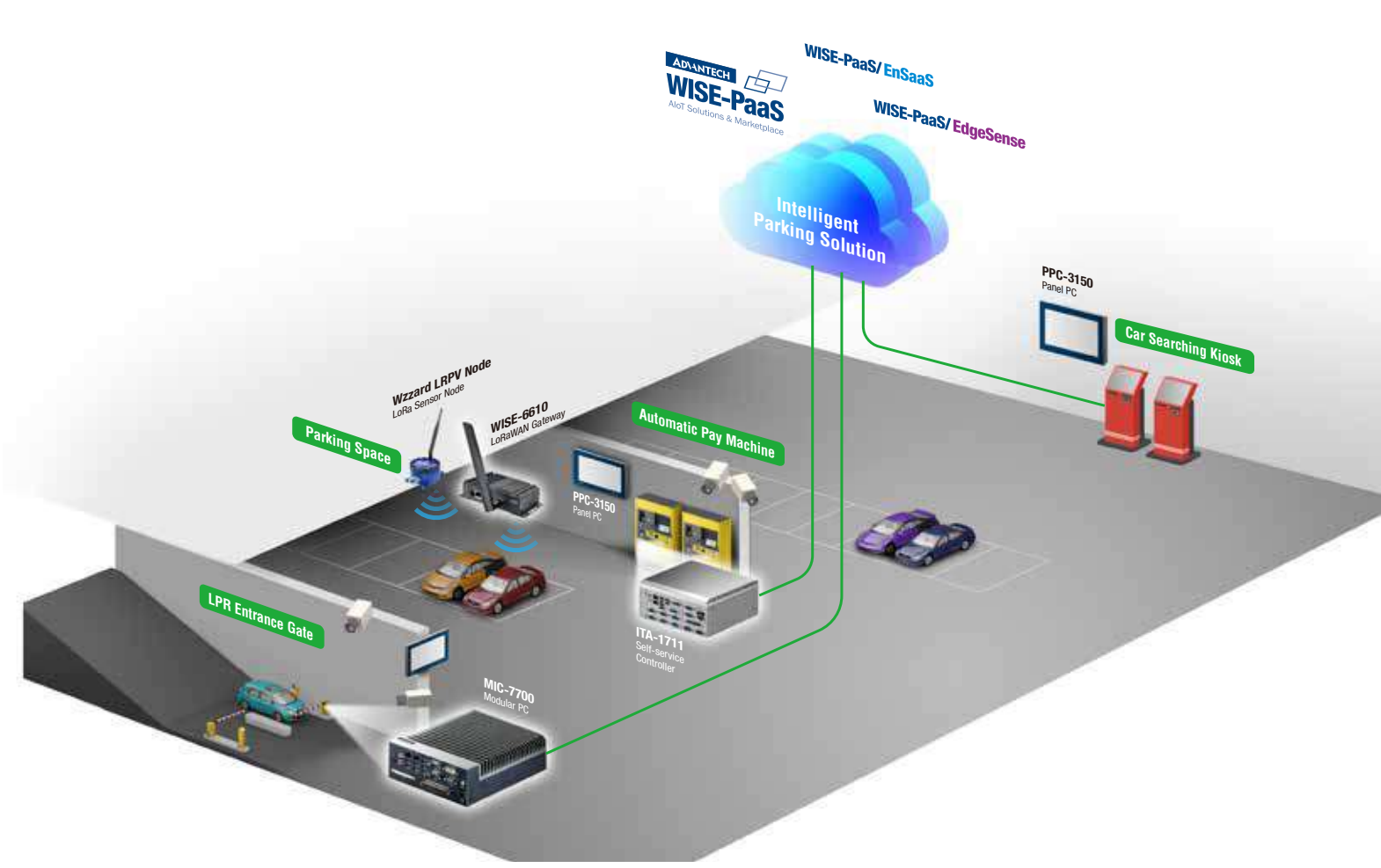
According to the requirements of the project owner, the new system needed to manage 400 parking spaces while providing a high-quality user experience and taking into account the needs of different customers who wished to pay by various methods: third-party payment, EasyCard, credit card, and cash. The project also needed to minimize labor and management costs.

System Overview

Three SaaS applications are needed for this project: a parking guidance and car-searching system, a toll collection management system, and a smart lighting control system. In conjunction with these three sets of software, it was necessary to install a license plate recognition gateway machine, a smart car-searching kiosk, an automatic toll collection machine, wireless sensing devices for each parking lot, and parking guidance signs.

Advantech divided this project's cloud connected smart parking service into four parts: the bottom layer was for the smart edge application, the gateway system that handled vehicle entry and exit; the second layer was responsible for parking spot guidance after entering the parking lot, as well as parking grid sensing and automatic lighting control; the third layer was the WISE-PaaS cloud platform that acted as a bridge between devices and applications; and the top layer was the three SaaS applications developed by the system integrator.

Advantech's SRP was a complete edge-to-cloud solution, including the adoption of three industrial computers – MIC-7700, ITA-1711, and PPC-3150 – by the bottom layer. These computers provided a high-performance edge computing hardware platform with their compact sizes and offered good heat dissipation due to the fanless wide-temperature design. The Wzzard sensor



node and the WISE-6610 gateway on the second layer installed in the parking spots could be configured as wireless to save on wiring costs.

The third layer was the WISE-PaaS cloud platform which allowed developers to easily design their own SaaS applications through the WISE-PaaS/EnSaaS database, IoT hub, and dashboard features. Through the help of the cloud message and remote control features of WISE-Pass/EdgeSense in managing the underlying devices, users could diagnose, restore, and restart remotely without having to visit the site.

Conclusion

Advantech's Solution Ready Packages (SRP) for cloud connected services provide a wide range of hardware products for Edge Intelligence, required sensing and wireless communication products in field environments, and a ready-to-use PaaS IoT cloud platform.

Why Advantech?

- Advantech SRP reduces the burden of development manpower and significantly reduces the cost of after-sales maintenance
- Offers solutions with flexible expansion and configurations for commercial parking lots and parking lots located in office buildings

Product Introduction

MIC-7700

Compact Fanless System with 6th/7th Gen Intel® Core™ i CPU Socket (LGA 1151)

ITA-1711

Intel® Celeron™J1900 Fanless Compact System with Multiple COM Ports and Dual Displays

PPC-3150

15" Fanless Tablet Computer with Built-in Intel® Atom™ Quad-core Processor

Wzzard LRPv Node

Industrial-grade LoRa Dedicated Sensing Node

WISE-6610

Industrial LoRaWAN Gatweay

WISE-PaaS

Industrial Internet of Things Cloud Platform

Roadway Solution

Intelligent Video Traffic Monitoring for Self-Adaptive Traffic Signal Control System

Traffic Management

Traffic Signal Control System

Project Introduction

Cities consist of roads and streets where all types of vehicles: pedestrian, bicycles, cars, and buses intersect. Traffic signal controls at intersections highly impact vehicle activity, conflicting movement and capacity. To achieve an effective transportation solution that maintains safety but permits better traffic throughput, accurate traffic monitoring is needed to understand vehicle movements and flows throughout the city.

System Requirements

The AI traffic monitoring solution included a self-adaptive traffic light system, edge AI system, and a backend AI inference server; all integrated into a carefully designed dataflow. The edge AI system grabs video streams from the IP cameras and then analyzes the content using inference. Power-over-Ethernet (PoE) supplies power to the IP cameras through a general purpose RJ45 LAN port, which makes it much easier to deploy cameras in remote areas. Low power consumption, fanless design, and wide-temperature functions were necessary to meet the requirement as a road-side system since the equipment would be hung on traffic signal structures to control traffic lights.

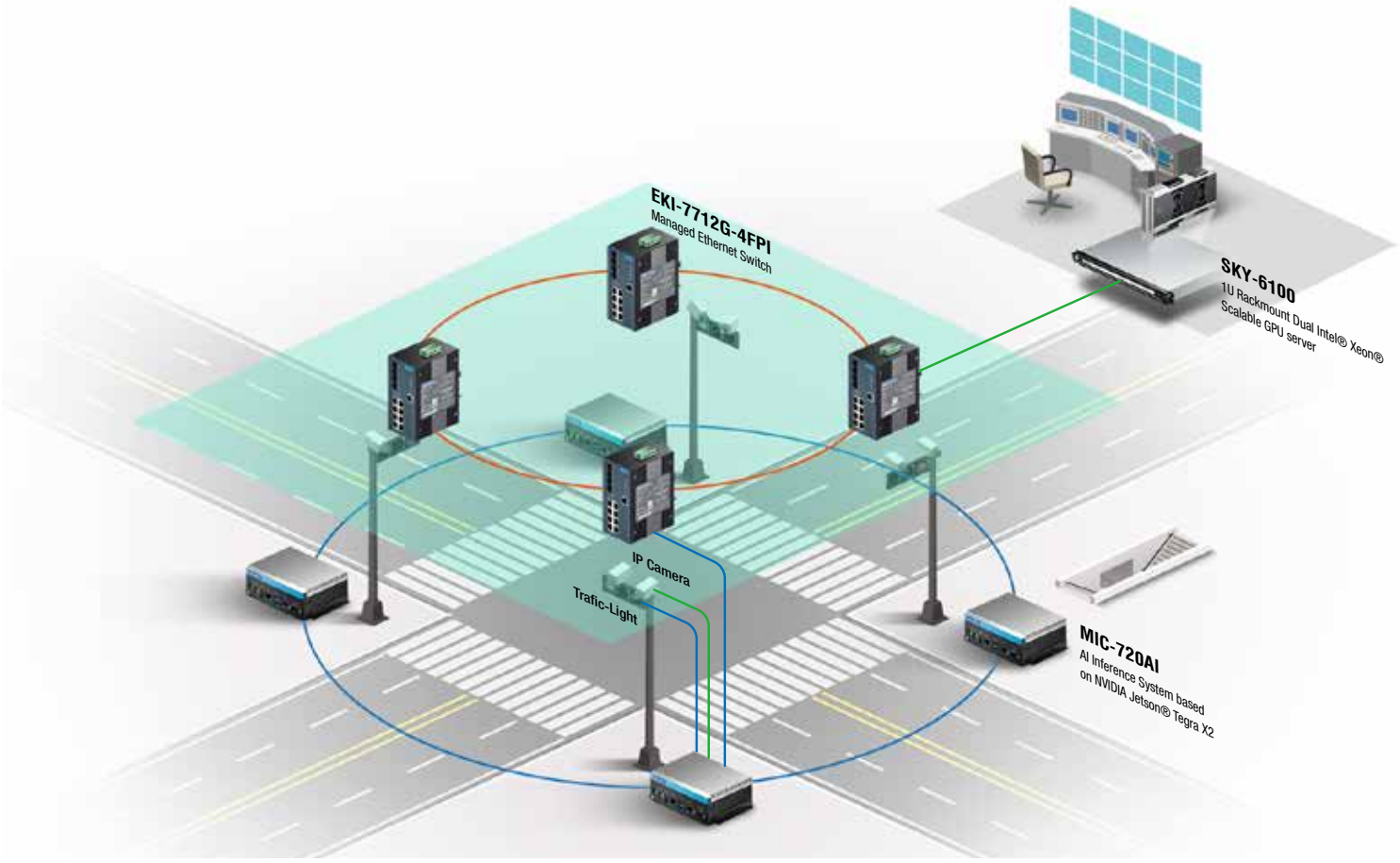
After traffic monitoring is completed at the road-side, the raw data will be transmitted back to the central control room. The AI inference server leverages high processing power to meet the massive inference processing requirements and to be able to analyze the set of metadata via pre-trained deep learning models. Then, the self-adaptive traffic lights can be managed from the traffic center control room.

System Implementation

Advantech's MIC-720AI compact modular computer based on the NVIDIA® Jetson™ Tegra X2 (TX2) was used as the edge AI system. MIC-720AI leverages AI inference technology to perform traffic monitoring on the massive amounts of collected data; surpassing traditional vehicle recognition methods used for object tracking. MIC-720AI fulfills deep learning computing requirements at the road-side where metadata is packaged and transmitted to the central control room. MIC-720AI also provides multiple interfaces to integrate with other traffic equipment.

With a unique Ethernet and fiber combination (8 GbE + 4 SFP ports), EKI-7712G-4FPI supports full Gigabit Ethernet connectivity, and PoE+ with 240 Watts PSE capability, which is ideal solution for most advanced network management.

Integrated with an intuitive dashboard in the control room, the SKY-6100 AI inference server not only receives metadata from all edge AI systems but also monitors all traffic conditions through deep learning models. If any abnormal situations occur, the AI server can recognize it and manage the traffic lights adaptively. Through the analytic power of SKY-6100, the self-adaptive traffic



signal control system makes the traffic in the city flow smoothly and efficiently. Now, the city government can have a high-level overview of all traffic in the city in real time. Moreover, traffic data and information are constantly needed to assess current and past performance and to predict future performance. All this helps pro-active transportation planning such as traffic impact assessments, public transportation, and road design to make a better future transportation infrastructure.

- The industrial grade MIC-720AI takes advantage of NVIDIA® Jetson™ features to implement AI at the road-side
- The EKI-7712G-4FPI features a wide -40 ~ 75 °C (-40 ~ 167 °F) operating temperature (EKI-7712G-4FPI) and NEMA TS2 rating, making the switch an ideal solution for use in traffic applications
- SKY-6100 1U rackmount server supports up to 5x state-of-the-art NVIDIA TESLA P4 to analyze large-scale AI

Conclusion

To fulfill real-time traffic monitoring applications and self-adaptive traffic light control, Advantech provides an AI end-to-end solution and offers full range edge AI systems and AI inference systems, which have sufficient deep learning capabilities to perform AI inference.

Why Advantech?

- AI traffic monitoring solution with a well-designed end-to-end dataflow
- Industrial edge AI system empowers AI computing at the road-side with minimum deployment effort
- Deep learning computing at the backend permits self-adaptive traffic light control

Product Introduction

SKY-6100

1U Rackmount Dual Intel® Xeon® Scalable GPU server

MIC-720AI

AI Inference System based on NVIDIA® Jetson® Tegra X2

EKI-7712G-4FPI

8GE PoE and 4G SFP Managed Ethernet Switch, IEEE802.3af/at, 46~57VDC, -40 ~ 75 °C (-40 ~ 167 °F)

13.

Transportation Hub Solution

Complete Solution for Smart Maintenance and Management Services for Dubai International Airport

Airport

Operation and Maintenance Management

Project Introduction

In order to become a world-class international airport that provides smart passenger services, more and more airports have actively introduced advanced passenger-centric systems. Dubai International Airport decided it was time to introduce an Airport Operations Database (AODB), which covers four major functions—landside operations, information management, airside operations, and billing and invoicing operations.

System Requirements

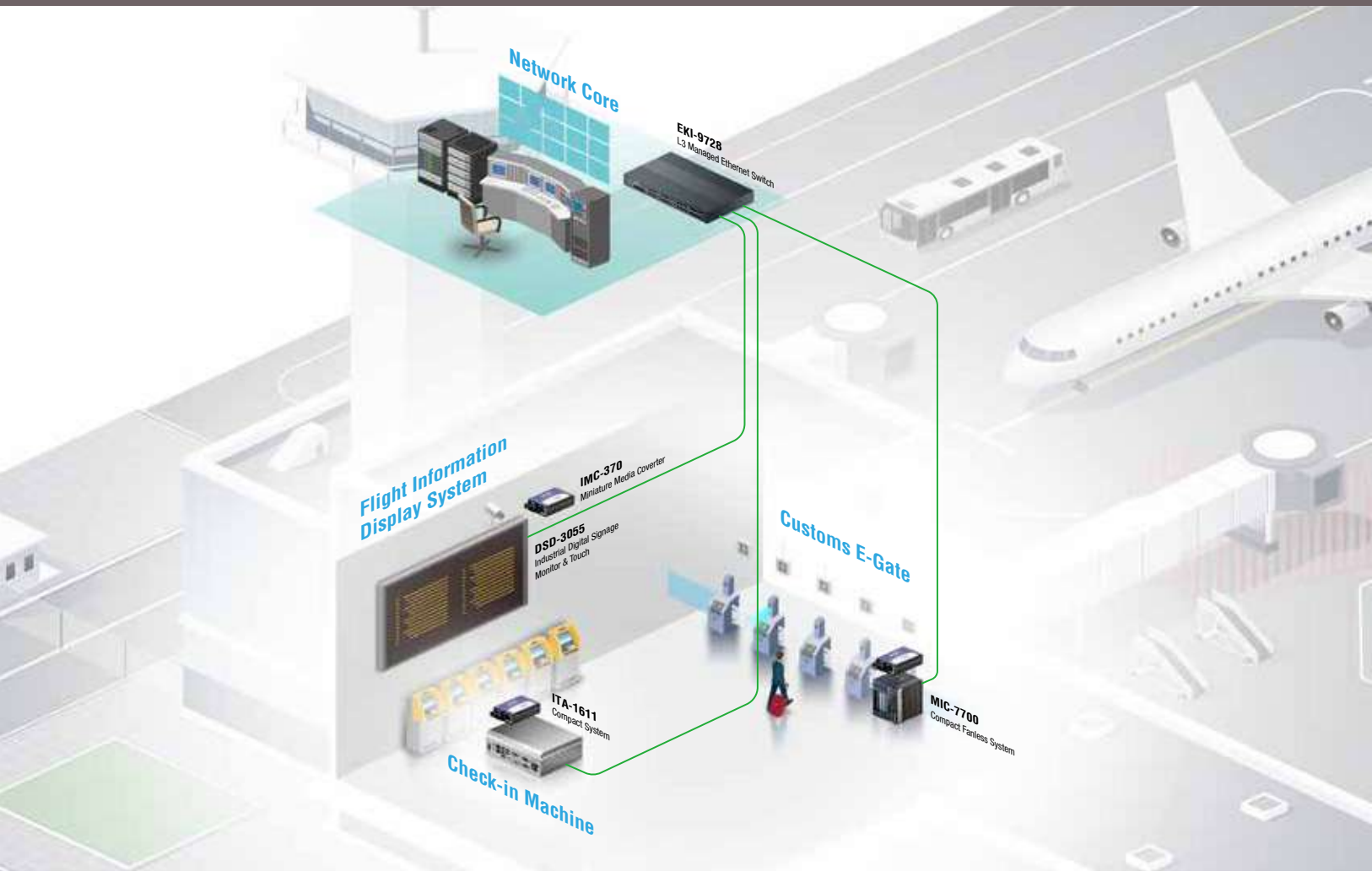
This terminal required a variety of automation equipment including self-service check-in machines with network surveillance cameras and passport and barcode scanners, automatic customs clearance systems with fingerprint and face recognition, automatic boarding systems with face recognition, and digital signage hardware that can display flight information across multiple screens. In order to allow the AODB in the central control room to be connected to all other equipment, the contractor needed to specify a fiber-optic network that could transmit large amounts of data over long distances.

To facilitate maintenance for such a large airport, the contractor needed ready-to-use equipment with remote management capabilities to reduce custom in-house development. At the same time, the contractor also hoped to reduce the risk of product incompatibility by working with a single service vendor to help reduce complexity, troubleshooting, and maintenance.

System Overview

Advantech's complete solution contribution for these smart airport services included two broad categories of products. The first was a number of hardware platforms. This included two compact fanless systems (ITA-1611 and MIC-7700), and a fanless digital signage platform (DS-570, with a 55-inch display screen DSD-3055). The second was a fiber-optic network comprising of an L3 managed switch (EKI-9728), a managed redundant industrial grade PoE switch (EKI-7710), a fiber media converter (IMC-370), and a centralized powered media converter chassis (IMC-318I).

Since all hardware platforms are equipped with an IMC-370, the self-service check-in machines embedded with ITA-1611, and the automatic customs clearance systems and boarding systems configured with MIC-7700, could transmit data to a number of EKI-7710 switches installed on the east, west, south, and north sides of the terminal. After the signal conversion process, data is then forward to the central control room of the airport and the images and data can be stored in the AODB for integration and analysis. At the same time, data in the AODB can also be transmitted over the fiber network to the DS-570 signage platform connected to three DSD-3055 displays, allowing the Flight Information Display System (FIDS) to output the latest information on large screens.



Most importantly, all of the required products for this project were purchased from Advantech, which means the hardware platforms and fiber-optic networks have a longer MTBF than commercial products, and provide guaranteed reliability and durability. Moreover, remote device management functions are provided as standard and an administrator can monitor all equipment operations scattered throughout the airport and in the central control room. The system can also send warning notifications about abnormal events to help administrators react more accurately.

Conclusion

The Dubai International Airport officially introduced their smart airport services in 2017 and because of the remarkable results obtained, the airport decided to use Advantech products for all their terminals to provide their passengers with the world-class services they have come to expect.

Why Advantech?

- Hardware platforms and fiber-optic networks from Advantech offers a longer MTBF for guaranteed reliability and durability
- Remote device management enables real-time equipment operation monitoring for administrators to prompt respond and action more accurately

Product Introduction

ITA-1611

Intel® Celeron™J1900 Fanless Compact System with Dual Gigabit Ethernet LAN and Dual Displays

MIC-7700

Compact Fanless System with 6th/7th Gen Intel® Core™ i CPU Socket (LGA 1151)

DS-570

Intel® Celeron® N2930/ J1900 Quad-Core™ SoC with Advanced Graphics Signage Player

DSD-3055

55" FHD Industrial Digital Signage Monitor & Touch

EKI-9728

Industrial Rackmount L3 Managed Switch

IMC-370

10/100/1000Mbps Micro Media Converter

Transportation Hub Solution

ECU Power and Energy Communication Management Computer Seamlessly Connects the Energy Consumption Management System in Beijing's Daxing International Airport

Airport

Energy Management

Project Introduction

Research in Europe has shown that the amount of energy consumed by civilian airports is comparable to that of a small town. A significant portion of this energy is wasted by inadequate control and management. This has prompted many airports to adopt intelligent operation and maintenance (O&M) platforms. These airports now use automated controls to prevent unnecessary waste, improve monitoring and control efficiency, and reduce overall energy consumption.

System Requirements

Beijing Daxing International Airport is positioned as a large-scale international aviation hub and is committed to setting a new standard for green airports in China, with efficient energy conservation and environmental protection. An unmanned energy and equipment O&M platform is required to establish for comprehensive monitoring of the air-conditioning, lighting, water supply, heating, elevators, other equipment with high energy consumption, as well as related instrumentation.

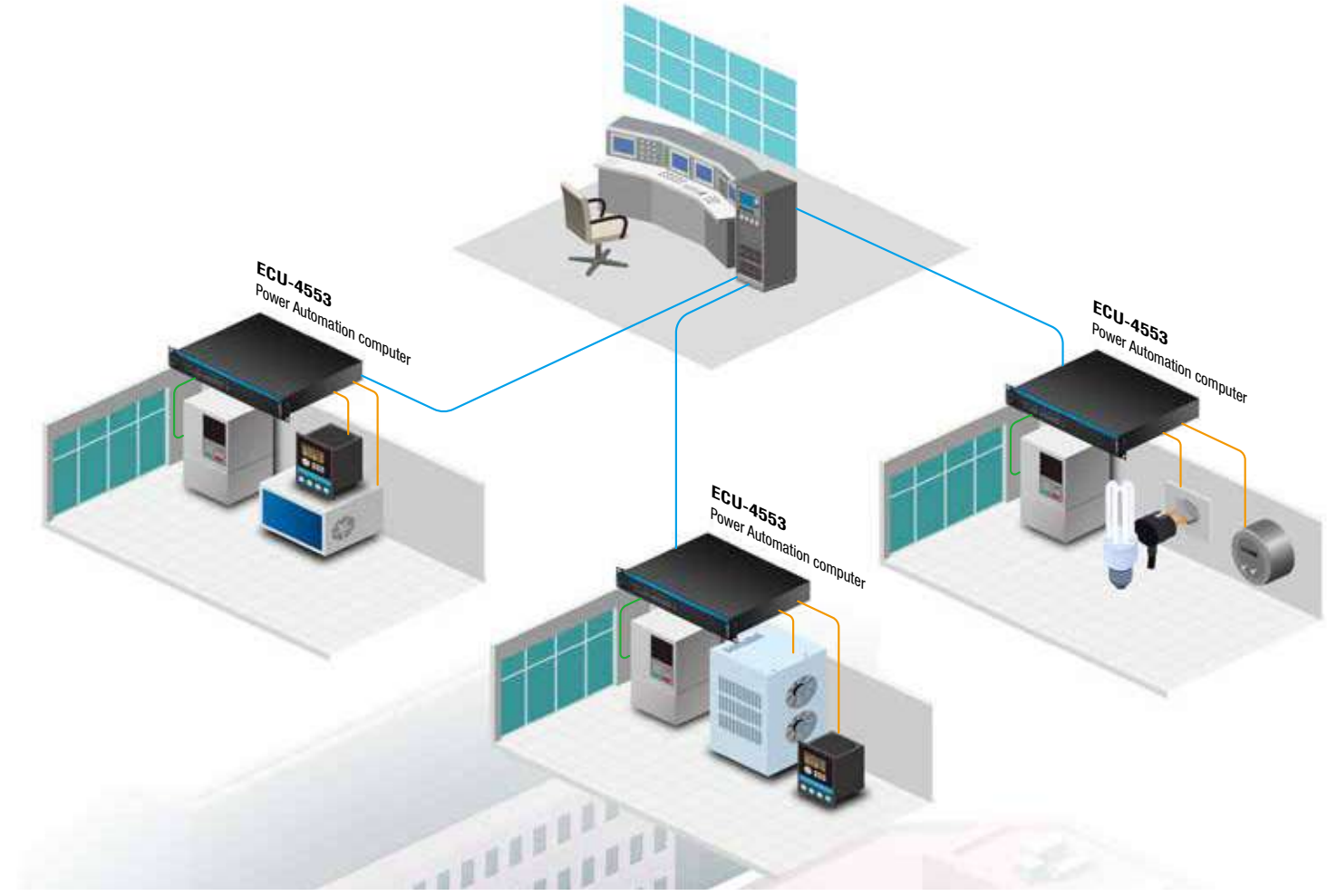
Computers were installed in each electrical room as data gateways to collect data, including an inventory of energy consumption information in the airport. The data were then employed to analyze potential energy savings before interconnected mechanisms were implemented to reduce energy consumption. The gateways convert data from various communication protocols to the IEC 61850-9 format before uploading to the integrated O&M platform.

System Overview

Beijing Daxing International airport has 258 electrical rooms, each of which is to be equipped with an Advantech ECU-4553 as the data gateway. This unit was selected because it can connect a high number and wide variety of bottom-layer equipment to the upper-level management system.

The system can also issue control commands to field site equipment via the ECU-4553. For instance, based on flight information, it can predict the number of passengers that will be in given region and implement air-conditioning control measures where there are fewer passengers. In addition, when the system receives an anomaly from the transformer signifying that a temporary blackout has occurred, the backup power generator can be remotely activated from the monitoring center.

ECU-4553, which has a built-in TI Cortex A8 processor, is a high-performance industrial-grade communication management computer that meets IEC 61850 standards. It is equipped with the RT-Linux operating system, which facilitates real-time communication and increases the accuracy and efficiency of the energy consumption monitoring system. In terms of electromagnetic compatibility (EMC), the ECU-4553 meets hardware standards and regulations under IEC 61850-3. It can



withstand external electromagnetic interference without affecting the operations of other equipment or devices. Its operations remain stable even when installed in an environment with electrical and electronic equipment that may otherwise cause interference.

For seamless connectivity, the ECU-4553 provides 4 LAN ports and 16 RS-232/485 serial ports. It can easily connect to equipment that uses different protocols (e.g., IEC-60870-5-104, IEC-60870-5-101, Modbus/RTU, and Modbus/TCP), thus satisfying the current project's connection requirements while reserving room for future system expansion.

Conclusion

Advantech's ECU-4553 communication management computer is not simply a high-performance computer designed for power and energy applications; it excels at developing intelligent energy management systems. This smart energy solution received wide acclaim as it saved operating costs and optimized management efficiency

Why Advantech?

- High-performance and high-stability industrial-grade ECU-4553 with sufficient computing power for processing massive amounts of data
- Satisfies the project's connection requirements while reserving room for future system expansion

Product Introduction

ECU-4553

Industrial Computer Designed for Power and Energy Applications with Built-in TI Cortex A8 Processor

Regional Service & Customization Centers

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