ADLINK
Leading EDGE COMPUTING

Solution Brief

AI-enabled Video Surveillance System for Airports

Rugged AIoT Platform AVA-5500

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AI-based Airport Video Surveillance System Enabled by ADLINK's AVA-5500, a Rugged, Fanless AIoT Platform with NVIDIA Quadro® GPU Embedded for Real-time Video/Graphics Analytics

Customer Application

Airports around the globe are facing increasing operational challenges as a growing volume of passengers complicates airport management on all fronts. Compounding the situation are adverse weather conditions such as dense fog or rain, which often hamper visibility and result in delays and cancellation of flights at many major airports serving as key domestic and international air traffic hubs.

To tackle the visibility challenge, a major airport in China with annual traffic of 50 million-passengers is developing an enhanced video surveillance system (EVS), which will increase its current deployment of cameras at control tower blind spots and provide tower controllers with a panoramic (over 180°) view of the airfield. The system also provides tracking by zooming in on objects-of-interest and displaying aircraft with their corresponding flight information.

This EVS system employs 4 to 8 cameras for each of a dozen controller blind spots, thus generating nearly 100 independent video streams simultaneously. Collectively these cameras provide a mosaic of video streams that form a wide angle view displayed on a video wall. This allows airport controllers to have a clear command of the entire airfield, reducing the need for on-site visits or manual inspections.

At the heart of its intelligent EVS system, the airport is deploying ADLINK's AVA-5500 AI-enabled Video Analytics (AVA) platform to analyze every blind spot. Each AVA-5500 connects securely to a group of video input streams, implements advanced graphics and artificial intelligence (AI) processing, and uploads the results to backend servers.

The EVS system provides real-time intuitive monitoring of the airport, enhanced by improved visibility during night and adverse weather, remarkably increasing airport safety, security and operational efficiency. Integrated AI algorithms automatically detect foreign objects on runways and taxiways to help streamline airport operations, thereby reducing personnel and associated labor costs.

Rugged AIoT Platform AVA-5500

Challenges

The EVS system must handle complex challenges due to the application environment of the airport and its special operational requirements. These challenges include:

- The requirement for higher quality video and high number of streams to provide clearer views and adequate coverage
- The demand for implementing edge computing with ultra-high reliability under harsh environmental conditions
- The need for more advanced real-time, remote and AI technologies to achieve higher intelligence and smart air traffic control and security surveillance

Higher Quality Video

Generally an airport consists of a large perimeter surrounding wide-open spaces, large facilities and construction areas that might easily create controller blind spots. Adverse weather conditions such as rain, snow or dense fog will also decrease visibility.

The EVS system deploys cameras at blind spots and combines views from different angles to generate a panoramic view of the airfield on a video wall display. Controllers sitting in the tower can clearly see every square meter of runways, taxiways, and ramps via an intuitive and user-friendly interface.

However, different lighting conditions and their variations at different corners of the airfield throughout the day and night may produce discontinuities in the video image. To achieve a seamless and higher quality video presentation, the EVS system employs advanced graphics processing software. Accordingly, a powerful GPU is a paramount requirement for the EVS system.

Rugged Edge Computing in the Field

The airport EVS system deploys outdoor edge servers in a weatherproof enclosure to handle video processing and target tracking – tasks traditionally performed by indoor backend servers. Using the AVA-5000 to process data at the edge alleviates backend workloads, reduces network bandwidth requirements, therefore decreasing expenditures in data processing and transmission while increasing efficiency and real-time performance.

However, edge servers need to be able to operate in harsh outdoor environments at airports, including extreme temperatures and vibrations. The AVA-5500's fanless design, wide operating temperature range, MXM graphics cards with integrated cooling solution, and rugged connectors provide the reliability required for outdoor edge servers which must be capable of withstanding adverse conditions and maintain 24/7 operations.

Need for AI-based Surveillance

To avoid aircraft collisions or security threats, air traffic controllers must closely watch all activities on the airfield. But it is impossible for human staff to be constantly vigilant without distraction, and human eyes may miss subtle signs of danger—for example, a small foreign object on a runway or taxiway that may cause significant damage to aircraft engines.

To address the shortcomings of human surveillance, next-generation video surveillance systems are incorporating cutting-edge AI technology to increase intelligent functions such as automatic detection of foreign objects, real time alerts and alarm triggering. Implementing AI requires high CPU and GPU power to cope with requirements of advanced video analytics.

ADLINK Solution

The ADLINK AVA-5500 platform deployed in this EVS system features an embedded NVIDIA Quadro® GPU MXM module and is EN50155-certified, and exemplifies ADLINK's extensive expertise in AI, IoT and edge computing technologies. With a robust, fanless and rugged design delivering compelling CPU/GPU processing power with assured reliability, the AVA-5500 is ideally suited for outdoor video analytics applications at the edge, especially for transportation such as airports and railways.

Embedded GPU Video Analytics Platform

The traditional architecture for video surveillance uses servers with add-on graphic cards to meet video processing requirements. The edge connector design of PCIe graphics cards makes them unreliable for long-term use in harsh environments. By utilizing MXM graphics modules secured in place with screws and thermal pad, the AVA-5500 is able to provide reliable continuous operation around the clock.

Powered by a 7th Gen Intel® Core™ i7 processor (formerly Kaby Lake) and an NVIDIA Quadro GPU MXM module, the ADLINK AVA-5500 is the only fanless edge AI platform with embedded GPU on the market at present. By partnering with NVIDIA for GPU technology, ADLINK's GPU-based NVIDIA products offer longevity backed by at least 5-year service and support.

Rugged Design for Outdoor Extremes

The ADLINK AVA-5500 is a dedicated transportation edge server with rugged design features including:

- Fanless construction with convection cooling eliminates downtime due to fan breakdown and minimizes the ingress of dust
- Embedded GPU with securable I/O connectors to resist shock and vibration
- Wide operating temperature range to withstand extreme weather (max. -25°C to 70°C)
- Wide input power voltage range (16.6 to 137.5VDC) with rugged M12 connectors

Small Footprint for Convenient Installation

With compact dimensions of only 360mm(W) x 204.5mm(D) x 73.6mm(H), ADLINK's AVA-5500 strikes the perfect balance between size, performance and power(SWaP) consumption for graphics intensive outdoor applications, all while delivering an excellent price–performance ratio. Its small footprint allows for easy mounting onto the outer walls of terminal buildings or installations in locations where space is limited.

Advantages

- Excellent price–performance ratio: high processing power enables intense computation for video analytics and AI-enabled applications
- Powerful embedded GPU meets demands for high-quality video processing to improve visibility issues for airport video surveillance
- Processing data at the edge alleviates backend workloads, reduces network bandwidth requirements, facilitating quicker responses and situational awareness
- Robust design suited for transportation and extreme outdoor applications involving extreme temperatures, shock and vibration

AVA-5500 Series

Rugged, Fanless AIoT Platform with NVIDIA Quadro® GPU Embedded for Real-time Video/Graphics Analytics

- 6th/7th Gen Intel® Core™ i7 Processors (formerly Skylake and Kaby Lake)
- NVIDIA Quadro® GPU MXM 3.1 Type A/B module on PCI Express x16
- 8x M12 GbE (4x PoE), 4x RS-422, 4x USB 3.0, 1x DVI-I, 4x DisplayPort with lockable connectors
- Multiple storage options: 2x 2.5" SATA 6.0 Gb/s drive bays, 1x M.2 2280 slot, 1x CFast socket
- GNSS/3G/4G/WLAN support via 2x Mini PCIe slots and 2x USIM slots
- MVB/CAN bus support through Mini PCIe add-on module
- Wide range DC input: 24VDC, 36VDC, 72VDC and 110VDC
- EN50155-compliant, rugged, fanless design for harsh operating environments

System	Processor	Intel® Core™ i7-6820EQ CPU, 2.8GHz Intel® Core™ i7-7820EQ CPU, 3.0GHz
	Memory	Dual channel DDR4-2133 SDRAM with dual SODIMM sockets, up to 32GB
	BIOS	AMI UEFI
Storage		Up to 4x 2.5” SATA drive bays (two for AVA-5500 series, four for AVA-5510 series) 1x CFast slot, externally accessible 1x M.2 2280 (SATA)
Graphics		2x DisplayPort from Intel processor 4x DisplayPort with lockable design from GPU MXM (SKU dependent) 1x DVI-I from Intel processor
Connectivity	Ethernet	2x RJ-45 1000BASE-T Ethernet ports 4x M12 X-coded 1000BASE-T Ethernet ports with PoE Class 2 (7W), 1.5kV isolation 4x M12 A-coded 1000BASE-T Ethernet ports, 1.5kV isolation
	USB	4x USB 3.0 Type A ports Additional 2x M12 USB ports in AVA-5510 series
	Serial Port	4x DB-9 RS-232/422/485 ports (RS-422 by default) 2kVrms isolation
	Audio	Mic-in/ Line-out ports
	CAN/MVB	Supported by Mini PCIe card with two DB-9 outputs
	Wireless	2x Mini PCIe card slots are available for cellular modem or WLAN modules Compliant to Mini PCIe card spec v1.2 (PCIe and USB 2.0) Each Mini PCIe slot supports one micro-SIM 4x RP-SMA antenna connector cutouts
	In-system Expansion I/O	2x full size Mini PCI Express slots 2x USIM slots 1x Type A/B MXM slot on PCI Express x16 (P1000, P3000) 1x USB 2.0 wafer connector
	External I/O	4x M12 GbE with PoE ports; 4x M12 GbE ports; 2x RJ-45 GbE ports 6x DisplayPorts; 1x DVI-I port 4x USB 3.0 Type A ports; 2x M12 USB 2.0 ports (in AVA-5510) 2x DB-9 connectors reserved for MVB or CAN Mini PCIe module 1x Mic-in port; 1x Line-out port 4x antenna cutouts reserved Reset button; power button
Miscellaneous	LEDs	1x diagnostics, 1x storage, 1x WDT, 3x user defined
	Battery	Coin cell CR2032 (change to rechargeable golden cap by request)
	Board Management	ADLINK SEMA: Watch Dog, hardware monitor, runtime statistics, failsafe dual BIOS
	Power Supply	One 4-pin A-coded M12 connector +24V/+36V/+72V/+110VDC nominal power input (16.8V to 137.5V, EN50155 compliant)
	Power Consumption	149W on AVA-5500/6820/8G/P1000; 158W on AVA-5500/6820/8G/P3000 at 1. +24VDC in 2. CPU 100% loading 3. P1000 or P3000 100% loading
Mechanical	Dimension (WxDxH)	360mm x 225.1mm x 88.8mm (for AVA-5500) 360mm x 225.1mm x 105.4mm (for AVA-5510)
	Weight	6.3 kg
	Mounting	Wall mount
Environmental	Operating Temperature	Convection cooled Class OT1: -25°C to 55°C with P3000 MXM module (supported by condition) Class OT3: -25°C to 70°C with P1000 MXM module
	Storage Temperature	-40°C to +85°C
	Humidity	EN 50125-1, compliance EN 60068-2-78: 2012 Edition 2.0, Clause 4.2 at 40°C
	Vibration	EN50155 standard, method EN61373: 2010, Category 1 Class B
	Shock	EN50155 standard, method EN61373: 2010, Category 1 Class A & Class B
	Safety	EN 50153 EN50124-1
	Fire Protection	EN 45545-2:2013+A1:2015
	EMC	EN 50121-3-2, EN50155
Operating System		Windows 8, Windows 10 Ubuntu 16.04

WORLDWIDE OFFICES

ADLINK Technology, Inc.

9F, No.166 Jian Yi Road, Zhonghe District
New Taipei City 235, Taiwan
新北市中和區建一路166號9樓
Tel: +886-2-8226-5877
Fax: +886-2-8226-5717
Email: service@adlinktech.com

Ampro ADLINK Technology, Inc.

5215 Hellyer Avenue, #110 San Jose, CA 95138, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-360-0222
Email: info@adlinktech.com

ADLINK Technology Singapore Pte. Ltd.

84 Genting Lane #07-02A, Axxel Innovation Centre,
Singapore 349584
Tel: +65-6844-2261
Fax: +65-6844-2263
Email: singapore@adlinktech.com

ADLINK Technology Singapore Pte Ltd. (Indian Liaison Office)

#50-56, First Floor, Spearhead Towers
Margosa Main Road (between 16th/17th Cross)
Malleswaram, Bangalore - 560 055, India
Tel: +91-80-42246107, +91-80-23464606
Fax: +91-80-23464606
Email: india@adlinktech.com

ADLINK Technology Japan Corporation

〒101-0045 東京都千代田区神田鍛冶町3-7-4
ユニゾ神田鍛冶町三丁目ビル4F
Unizo Kanda Kaji-cho 3 Chome Bldg. 4F,
3-7-4 Kanda Kajicho, Chiyoda-ku, Tokyo 101-0045, Japan
Tel: +81-3-4455-3722
Fax: +81-3-5209-6013
Email: japan@adlinktech.com

ADLINK Technology Korea Ltd.

경기도 용인시 수지구 신수로 767 A동 1008호
(동천동, 분당수지유타워) (우) 16827
A-1008, U-TOWER, 767 Sinsu-ro, Suji-gu,
Yongin-si, Gyeonggi-do, Republic of Korea, 16827
Toll Free:+82-80-800-0585
Tel: +82-31-786-0585
Fax: +82-31-786-0583
Email: korea@adlinktech.com

ADLINK Technology, Inc. (Israel Liaison Office)

SPACES OXYGEN, 62 Medinat, Ha-yehudim st
4673300, Herzliya, Israel, P.O.Box – 12960
Tel: +972-54-632-5251
Fax: +972-77-208-0230
Email: israel@adlinktech.com

ADLINK Technology (China) Co., Ltd.

上海市浦东新区张江高科技园区芳春路300号 (201203)
300 Fang Chun Rd., Zhangjiang Hi-Tech Park
Pudong New Area, Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5192-3588
Email: market@adlinktech.com

ADLINK Technology Beijing

北京市海淀区上地东路1号盈创动力大厦E座801室(100085)
Rm. 801, Power Creative E, No. 1 Shang Di East Rd.
Beijing, 100085 China
Tel: +86-10-5885-8666
Fax: +86-10-5885-8626
Email: market@adlinktech.com

ADLINK Technology Shenzhen

深圳市南山区科技园南区高新南七道数字技术园
A1栋2楼C区 (518057)
2F, C Block, Bldg. A1, Cyber-Tech Zone, Gao Xin Ave. Sec. 7
High-Tech Industrial Park S., Shenzhen, 518054 China
Tel: +86-755-2643-4858
Fax: +86-755-2664-6353
Email: market@adlinktech.com

ADLINK Technology GmbH

Hans-Thoma-Straße 11
D-68163 Mannheim, Germany
Tel: +49 621 43214-0
Fax: +49 621 43214-30
Email: germany@adlinktech.com

Ulrichsbergerstraße 17
D-94469 Deggendorf, Germany
Tel: +49 991 290 94–10
Fax: +49 991 290 94–29
Email: germany@adlinktech.com

ADLINK Technology, Inc. (French Liaison Office)

6 allée de Londres, Immeuble Ceylan 91940
Les Ulis, France
Tel: +33 (0) 1 60 12 35 66
Fax: +33 (0) 1 60 12 35 66
Email: france@adlinktech.com

ADLINK Technology, Inc. (UK Liaison Office)

First Floor West Exeter House,
Chichester fields Business Park Tangmere,
West Sussex, PO20 2FU, United Kingdom
Tel:+44-1243-859677
Email: uk@adlinktech.com

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