Application Story

Bus Surveillance with Axiomtek's tBOX810-838-FL

For transportation authorities regulating public transit for a huge population travelling daily between work, school and home, reducing risks associated with driving and commuting is a top priority. Governments of the major cities around the world have been injecting enormous funds into new technologies in an effort to optimize transportation infrastructure and bolster the safety of the general public. Thanks to the increased incorporation of intelligent embedded solutions into transportation facilities, transportation authorities are now able to launch more initiatives to better protect drivers, passengers and pedestrians. Deployment of bus surveillance presents an excellent example in this regard, demonstrating how a successful model driven by innovative technologies has improved not just the efficiency but also the safety and security of mass transit.

Bus Security Surveillance System: How Does It Work?

A video surveillance system has become an indispensable necessity for bus fleet companies serving thousands of travelers each day. By enabling on-board video monitoring and recording, the surveillance system helps drivers and transportation staff stay vigilant about possible danger and allows them to react instantly to emergencies with necessary actions. Video surveillance is also widely integrated into protective measures on school buses, such as monitoring on-board student activity to discourage bullying and vandalism and tracking when and where each student boards and exits the bus. To deliver consistent performance on moving vehicles subject to a variety of road and weather conditions, the system must be built to survive extreme temperatures and humidity as well as to withstand the impact of constant shock and vibration.

An onboard surveillance system typically consists of the following equipment:

A suite of IP (Internet Protocol) video cameras installed on the bus to capture live video feeds from inside and outside the vehicle.

A rugged embedded computer functioning as a network video recorder (NVR) to provide onboard video storage. It is used in conjunction with IP cameras to enable simultaneous real-time video viewing and recording.

A PoE (Power over Ethernet) switch connecting the cameras to the onboard embedded computer via Ethernet cabling to create a CCTV (closed-circuit television) network. As IP cameras require relatively low power consumption, the bus surveillance system benefits from having a single Ethernet cable transmit both data to the onboard computer and electrical power to the cameras, eliminating the need for a separate power cord to supply electricity to the cameras and making the surveillance network easier to set up.

An anti-vibration, high brightness monitor connected to the onboard embedded computer to display live view for the driver.

Live video streaming & wireless downloading

Advanced bus surveillance systems are wirelessly enabled with Wi-Fi and cellular compatibilities. After the IP cameras send video to the onboard embedded computer, the computer streams live video through a secure cellular connection to a control center, where managers can access video images and monitor the bus remotely. Once the bus returns to the terminal, the computer offloads saved video footage wirelessly to the control center's database via Wi-Fi, 3G/4G LTE or other types of available communication networks. This way it helps save the trouble of having to manually pull the hard drive from the bus to download incident videos.

Intelligent technologies integrated for multiple applications

More than just providing live camera viewing and video recording for monitoring and backup purposes, an intelligent vehicle surveillance system equipped with GPS, WLAN and advanced computing technology can do anything like vehicle tracking and route navigation, passenger counting, bus fare reading, as well as sending alerts to drivers and first responders based on roadside and vehicle conditions. Assisted by analytical software solutions or cloud-based analytics, administrators at the monitoring station can process video data to collect incident statistics, build traffic prediction models or driver behavior simulations, and then feedback to the management or authorities for their reference.

Sophisticated power protection features

To adapt to buses running in a stop-and-go manner that might lead to severe voltage fluctuation, a complete set of power protection mechanisms is essential to maintaining the health and continuous operation of a vehicle surveillance system. This includes intelligent ignition settings of ACC on/off delay power management, shutdown delay, and over/under voltage protection, plus a redundant power supply as a second power source to backup potential main power loss. A resilient bus security system also relies on the ability of its provider to tailor and adjust the system to various power control needs specific to certain types of vehicles.

Use Case: Bus Surveillance System with Axiomtek's tBOX810-838-FL

The customer, a system integrator specializing in electronic security systems with ample experience in designing and executing large-scale security projects, was anticipating an industrial-grade embedded box PC to be used for building a bus surveillance system. After evaluating multiple industrial and consumer computing solutions, the customer opted for Axiomtek's tBOX810-838-FL - a fanless embedded box PC noted for its superior ruggedized design with international certifications of E-Mark and ISO 7637 - as the controller of choice for their onboard bus surveillance program.

Solution requirements

- Supporting NVR functions to capture high-quality video from inside and outside the bus and to store and transfer such video footage
- High performance with fanless, anti-shock and vibration design to reduce noise and to ensure reliable and durable operation in harsh environments
- Compact size to maximize space usage
- Large storage capacity
- PoE function support
- Redundant power supply for continuous system operation
- The ability to alert the driver and control center with location services was preferred

Installing the tBOX810-838-FL into the customer's bus surveillance system

Installation of the surveillance equipment included three IP cameras, an industrial PoE switch, a Wi-Fi router, and the tBOX810-838-FL transportation embedded PC.

- To make the best of limited space, the PoE switch was glued firmly on top of the tBOX810-838-FL system using industrial adhesive. The system connected to the three IP cameras via the PoE switch.
- The tBOX810-838-FL, along with the PoE switch, was mounted inside the overhead compartment above the driver's seat.

How does the tBOX810-838-FL enable the surveillance system?

1. Within approximately 30 seconds after starting the bus, the ACC function of the tBOX810-838-FL automatically turns on the computer and sends signal to activate the PoE (Power over Ethernet) switch to power on the IP cameras. The IP cameras receive power directly from the PoE switch, meaning only a single Ethernet cable is used for both power and data connection.
2. The tBOX810-838-FL records the video feeds received from the IP cameras.
3. The system uses wireless transmission to transfer video data to the control center as the bus is docking at the station.

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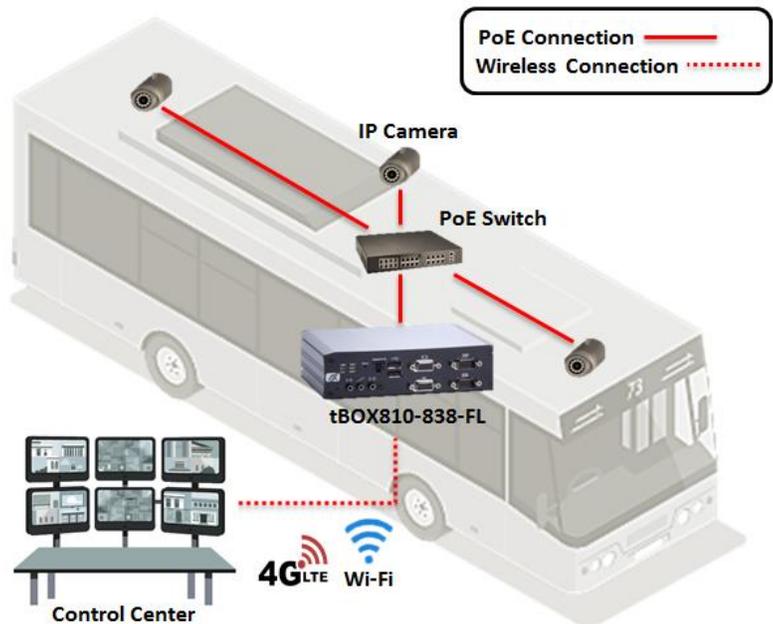
Axiomtek's Transportation PC Solution—tBOX810-838-FL

The tBOX810-838-FL embedded box PC is powered by an Intel® Atom™ processor E3845 1.91 GHz/E3827 1.75 GHz with onboard DDR3L memory up to 4GB. This transportation-certified embedded system has two PCI Express Mini Card slots and one SIM card slot for 3G/4G, GPS and Wi-Fi connections, while also including one 2.5" 9.5mm SATA HDD/SSD drive bay and one mSATA connector, making it easy to integrate more capabilities into the system. The transportation embedded PC provides a full scope of power protection that includes intelligent vehicle power management technology for ACC on/off delay, shutdown delay, and over/under voltage protection, along with redundant power supply that enables backup power input in case of potential main power loss. Enhanced by its robust structure and system design, the system is able to operate under a wide temperature range from -40°C to +70°C with vibration endurance up to 3 Grms.

Front view

Rear view

tBOX810-838-FL Fanless Embedded Box PC

Feature Highlights and System Configurations

‣ E-Mark, ISO 7637-2, EN 50155, EN 50121, DNV 2.4 and IEC 60945 certified

‣ Intel® Atom® processor E3845 or E3827

‣ 4GB DDR3L memory onboard

‣ Fanless design and wide temperature range from -40°C to +70°C (EN 50155 class TX)

‣ Anti-vibration up to 3 Grms

‣ Intelligent vehicle power management (ACC ignition)

‣ Two PCI Express Mini Card slots and one SIM Card slot

‣ 9 ~ 36V wide DC input with one phoenix connector

About Axiomtek Co., Ltd.

As one of the world's leading designers and manufacturers of PC-based industrial computer products, Axiomtek specializes in data acquisitions and control systems of rich diversity and modularization. With the upmost enthusiasm in serving their customers, Axiomtek has mirrored PC evolutions in various industries by shifting its focus toward the design and manufacture of PC-based industrial automation solutions, standing as a trustworthy long-term provider of industrial computers.

Established in 1990, Axiomtek has partnered with more than 60 distributors globally, offering more than 400 products through product lines of Industrial PCs (IPCs), Single Board Computers (SBCs), System on Modules (SoMs), Fanless and Rugged Embedded Systems (eBOX and rBOX), Intelligent Transportation Systems (tBOX), Industrial IoT Gateway, Touch Panel Computers (TPCs), Medical Panel Computers (MPCs), Digital Signage Solutions (DSSs), and Network Appliances (NAs) products.

Axiomtek is a Member of the Intel IoT® Solutions Alliance. A global ecosystem of more than 800 industry leaders, the Alliance offers its Members unique access to Intel technology, expertise, and go-to-market support—accelerating deployment of best-in-class solutions.