Industrial Equipment Manufacturing Success Cases

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- Test and Measurements

ADVANTECH

Enabling an Intelligent Planet

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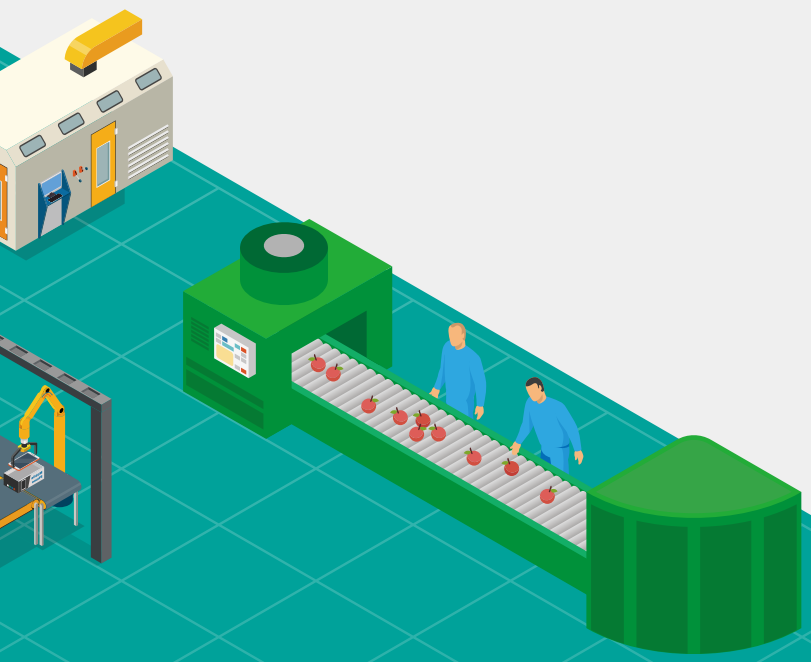
Founded in 1983, Advantech is a leader in providing trusted, innovative embedded and automation products and solutions. Advantech offers comprehensive system integration, hardware, and software, customer-centric design services as well as global logistics support, all backed by industry-leading front- and back-office e-business solutions. We cooperate closely with our partners to help provide complete solutions for a wide variety of applications across a diverse range of industries. Advantech has always been an innovator in the development and manufacturing of high-quality, high-performance computing platforms, and our mission is to continue to drive innovation by offering trustworthy automation products and services. With Advantech, there is no limit to the applications and innovations our products make possible.

01 Electronic Manufacturing

02 Semiconductor



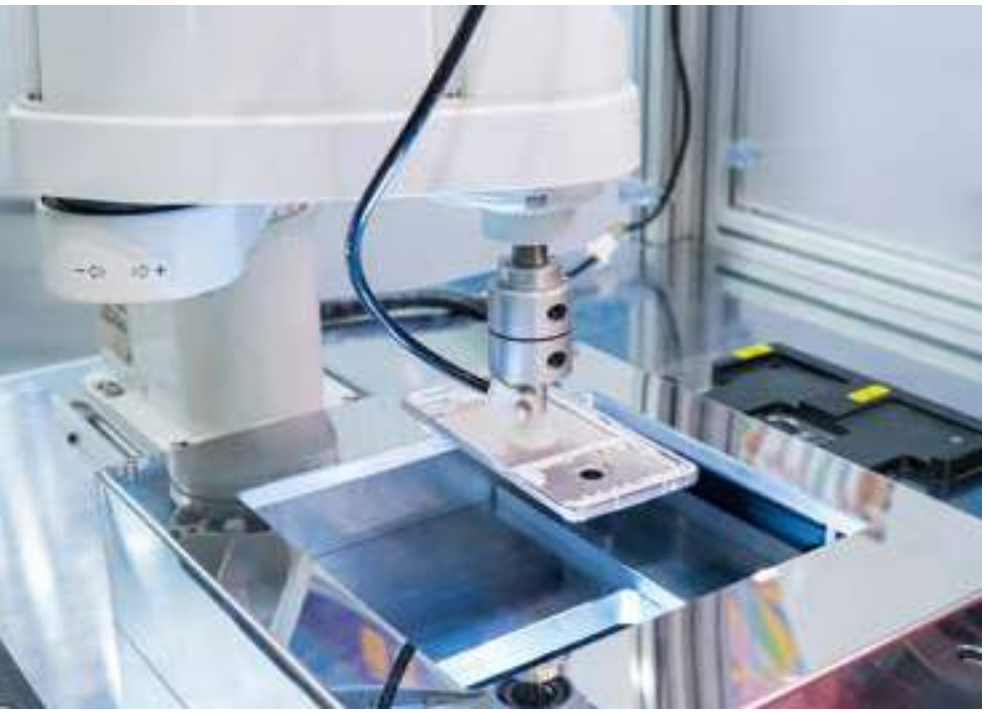
03 Food and Beverage

04 Components

05 Automated Guided Vehicle

06 Test and Measurements

A Production Line Solution for Mobile Phone Ceramic Covers



Location: **China**

Background

Ceramic covers have been developed as a new and innovative material for mobile phones. Their production requires complete automation in order to prevent defects during such processes as loading/unloading, polishing, and laminating. Concurrent automated visual machine inspection is also necessary to maximize yield. Demand and production standards are exceptionally high for this market, and thus fully automated around-the-clock production is essential to ensure both production quantity and quality.

System Requirements

Ensuring a highly efficient ceramic cover production system necessitates rapid motor control response. In this case, server request–response times had to be in the microsecond range to support the multi-axis robotic arms in the production line. Because development cycles are short, simple connections were needed in order to reduce assembly times.

With the automated loading/unloading system comprising many cylinders, sensors, and electromagnetic valves, it was essential to have stable, high-speed data acquisition cards with multi-I/O support. Specifically, the system required 108 digital inputs and 96 digital outputs while still conserving PCI slots for the controllers. Because defects are difficult to prevent during production and transportation, machine visual quality inspections are critical for this high-speed production environment, thus requiring high-performance data acquisition cards in addition to cameras with a high frame rate.

Finally, the controls needed to be simple so that operations could be managed via a single platform, thus ensuring efficient development, testing, adjustment, and on-site maintenance. To meet these requirements, the system had to support at least four PCI slots and two PCIe slots, have a high-mid tier processor, and perform reliably over long periods of operation.

Project Implementation

ACP-4020

4U Short Depth Intelligent Rackmount Chassis

AIMB-785

LGA1151 6th / 7th Generation Intel® Core™ i7/i5/i3/Pentium/Celeron ATX with Triple Display, DDR4, SATA III

PCI-1203

2-Port EtherCAT Universal PCI Master Card

PCI-1758UDIO

128-ch Isolated Digital I/O Universal PCI Card

PCIE-1674E

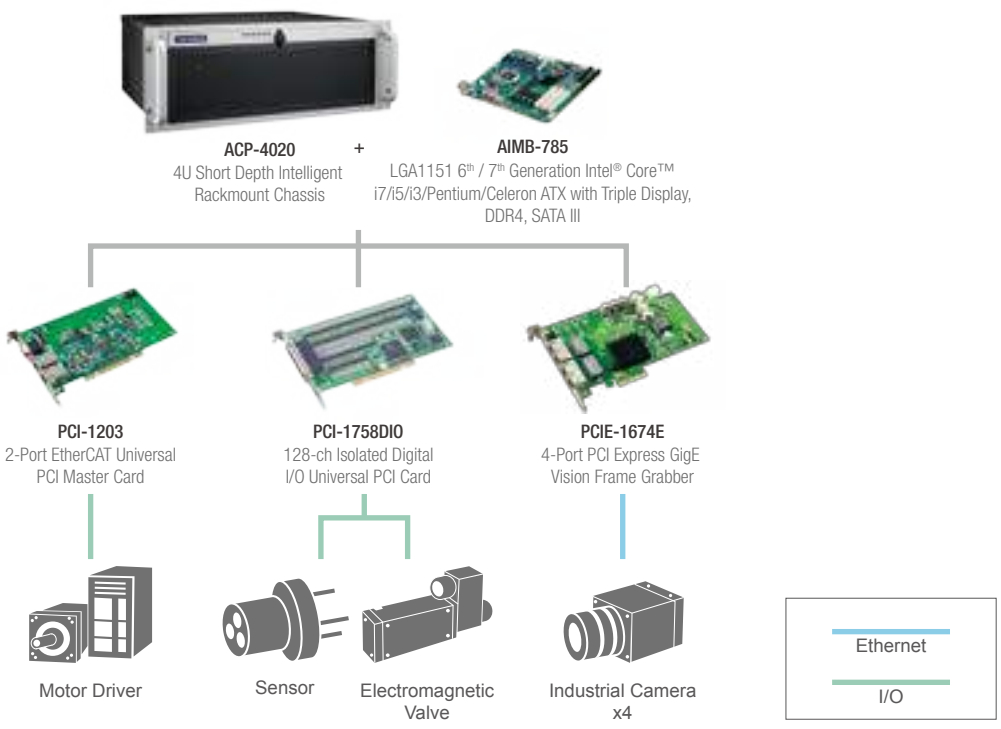
4-Port PCI Express GigE Vision Frame Grabber

System Description

Workflow for the loading/unloading system primarily comprises material loading, visual inspection, and material unloading stages. Upon completion of each process, automated visual inspection is performed to profile the workpieces. Using data signals, the system controls the motors to adjust the workpieces so that they are within the camera range of the next visual inspection machine.

During visual inspection, workpieces are checked for defects, and the corresponding motor control mechanisms are initiated according to whether the results are OK or NG, with OK workpieces proceeding to the next process and NG pieces being removed. The data from visual inspection are later used to generate statistical reports on such parameters as produced quantity, throughput yield, and efficiency. At the material offloading stage, workpieces that meet specification move rapidly along the production line for final packaging.

System Diagram



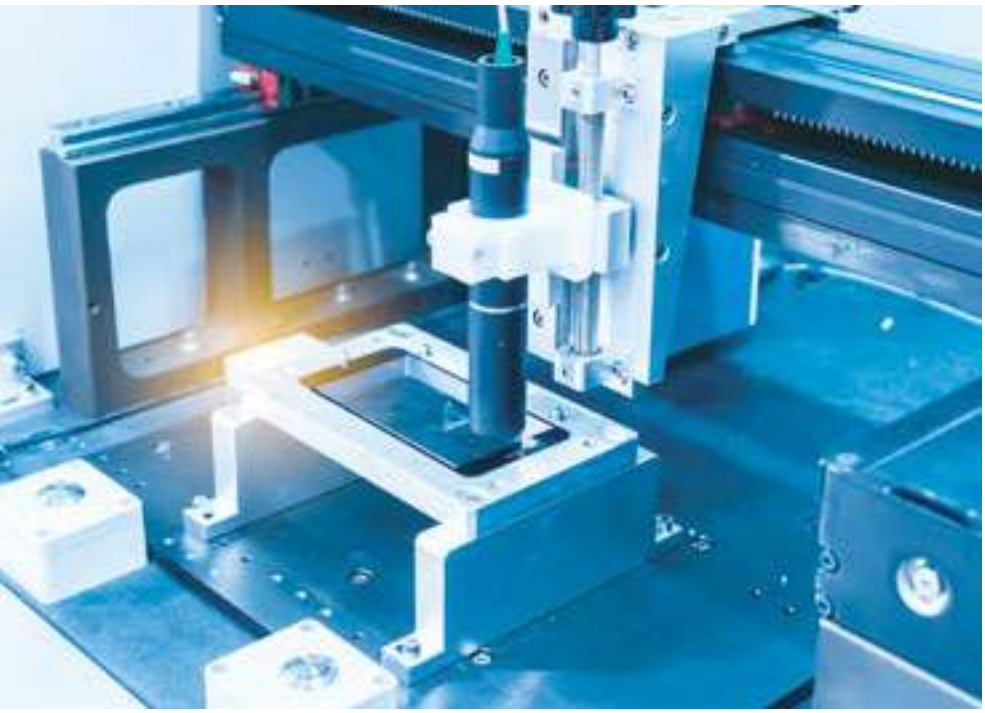
Why Advantech?

Our dedicated research team's extensive experience with motor control applications allowed us to provide professional support for pre-evaluation, sample development, and on-site adjustment.

For motor control, Advantech's PCI-1203 2-port EtherCAT master card was selected because it supports 16 axes that can be assigned to up to five groups, thus enabling automatic operation of the robotic arms on the production line. The card's onboard dual-core 650-MHz Arm® processor makes it optimal for real-time diagnostics, record control, and error management, all of which have made production line maintenance more convenient. Common Motion SDK support also makes it an effective EtherCAT control development platform for accelerating present and future project development. Control of the stack lights, stop buttons, valves, cylinders, sensors, and other auxiliary devices in the production line was achieved with the PCI-1758UDIO digital I/O card. In addition to providing 128 independent channels, this card also offers a high level of ESD protection, digital filtering, and message processing functions, thus providing a high level of control with only a limited number of cards. For image acquisition, PCIE-1674E image acquisition cards were adopted to link cameras for high-speed multi-angle monitoring, and their compatibility with commercial GigE Vision cameras allows for flexibility in camera selection.

Finally, system control was realized with the ACP-4020, which is the world's most popular choice for industrial PCs.

Advantech's Motor Control Integrated Solution for High-Precision Dual-Channel Adhesive Dispensers



Location: **China**

Background

For manufactured products requiring the application of industrial adhesives, paints, and other liquids, high-precision dispensers are employed to accurately dispense, inject, smear, or drip the substance in specific locations, typically as a point or in a line, circle, or arc. Adhesive dispensers are widely used in electronics, lighting, automotive, power generation, and other industries; in fact, they are one of the most basic types of equipment found in product manufacturing.

However, this type of dispenser technology is far from mature in China, and international brands, whose products generally involve high purchase costs, have a clear monopoly. To help the Chinese market overcome this, Advantech has worked with local smart equipment manufacturers to aid them in realizing a technological breakthrough.

System Requirements

This client's dispensers had three servo motors and three stepping motors. This included an XYZ platform where the Z-axis is an XZ step axillary module and a step control feed axis where the key axis is geared to five other axes.

To accommodate different product heights, dislocation sensors were needed to scan the nozzle height via laser in order to establish dual Z-axis control of the nozzle height. Of particular importance, the dispensing rate and movement speed had to be consistent, thus requiring automated comparative triggers for the adhesive valves.

To meet high-standard industry requirements in terms of precision and speed, particularly given that products tend to be very small, sufficient control needed to be achieved to produce dispersion points as small as 0.15 mm in diameter, line application widths of 0.168 mm, and straight angle turn radius of 0.5 mm, all of which need to be applied at speeds of up to 200 mm/s.

Project Implementation

ACP-4340

4U Intelligent Rackmount Chassis with 4 Hot-Swap Drive Trays

PCE-5129 / PCE-5B12-07

PICMG 1.3 CPU card supporting 6th / 7th Generation Intel® Core™ i Processor / 12-slot BP for 14-slot Chassis

PCI-1285

DSP-Based 8-Axis Stepping and Servo Motor Control Universal PCI Card

USB-4716

200 kS/s, 16-bit, 16-ch Multifunctional USB Module

PCI-1761

8-ch Relay/8-ch Isolated Digital Input PCI Card

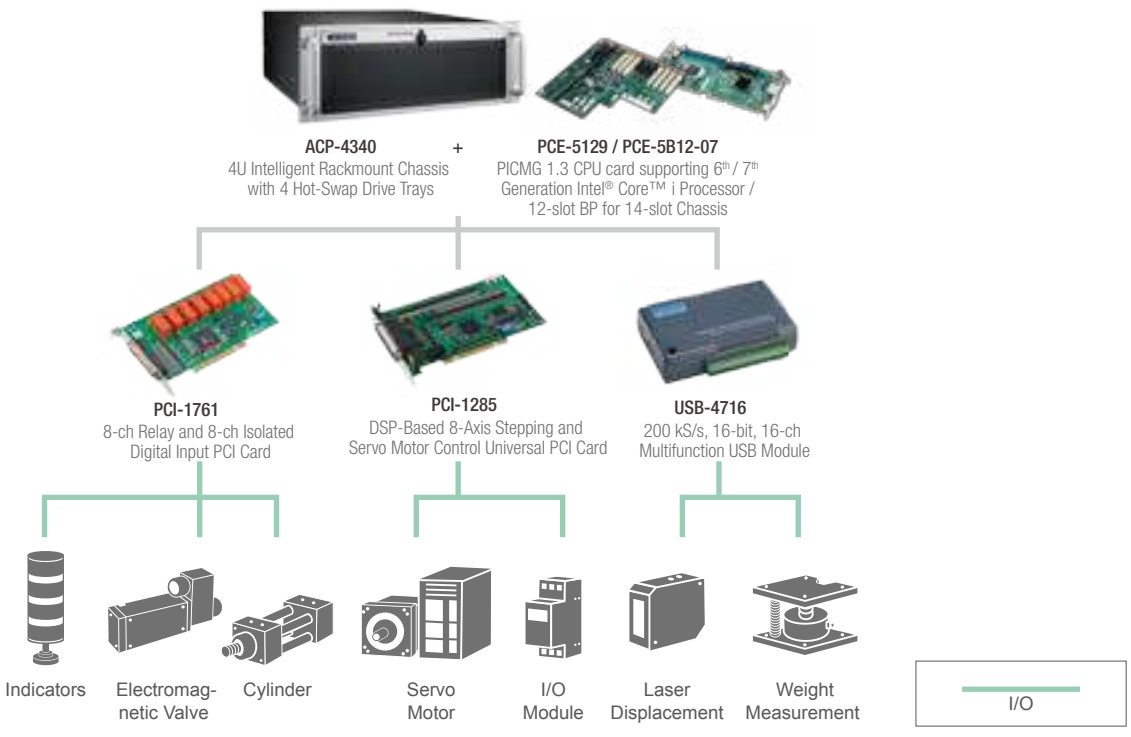
System Description

The workflow of the high-speed, high-precision dual-channel adhesive dispenser is divided into four stages: 1) material loading; 2) adhesive application; 3) weighing; and 4) completion.

At the material loading stage, the USB-4716 analog acquisition card and dislocation sensors are utilized for machine visual inspection, which involves calculating the PCB angle and height of the workpiece. These data are used as inputs to adjust the adhesive dispensers' valves, a process that is handled by the PCI-1285. At the dispensing stage, the adhesives are applied to the PCBs according to the programmed specifications, for which the PCI-1285 is again utilized to execute interpolation and various other functions aimed at axis control. At the weighing stage, the USB-4716 analog USB module determines whether the amount of applied adhesive meets the specified amount.

Finally, workpieces reach the product completion stage when the appropriate amount of adhesive is applied, at which point they are unloaded from the machine.

System Diagram



Why Advantech?

Of particular benefit to the customer, the PCI-1285's DSP structure allowed simplified system customization and control of the dual-channel adhesive dispenser. Furthermore, the PCI-1761 and USB-4716 ensured that high-speed and high-precision operation could be maintained in addition to allowing for future expansion while occupying minimal space.

This case shows that with the strong backing of a professional R&D team that is well versed in motor control algorithms and applications, Advantech can provide pre-evaluation, example code for development, and on-site adjustment for our customers.

A FOG Vision Control Solution for an LED Module Production Line

Location: **Korea**

Background

This manufacturer of LED module bonding machines was in the process of developing large vision machines that comprised 17 industrial PCs (IPCs) in a single machine. They had been testing several IPC brands to identify the ideal one that would improve the stability of their machines. Given the number of IPCs in each machine, having compact IPCs was a major priority for their project.

System Requirements

Most mobile devices, tablet PCs, and electric home appliances that use LCD panels are now being designed to use LED screens. In line with this trend, the new generation of mobile phones and tablet PCs produced by the world's most famous mobile phone manufacturer have been designed with LED panels produced by a Korean LED panel manufacturer. To accommodate the multitude of tasks that are typically performed in the manufacturing process, the customer needed to develop large FOG vision machines with 17 IPCs in a single machine. For this, there were several key considerations.

First, the machines required high-performance IPCs with high-end CPUs and four PCIe x4 slots to support up to 12 Ethernet cameras.

Second, with 17 IPCs in each machine, it was critical to downsize as much as possible in order to maximize the number of machines that could fit within a limited space. Third, to meet the LED manufacturer's deadline, our customer had to be able to make a rapid transition to mass-production; thus, they preferred to use an IPC that had already been fully verified by their R&D and QC teams. Finally, because the display company had decided to expand their LED production lines in Vietnam for this project, our customer also had to establish factories in Vietnam to shorten the delivery time and reduce costs. Therefore, having access to local technical and RMA services was critical.

Project Implementation

IPC-7130

Intelligent Wallmount Chassis with Dual Hot Swap Drive Trays

ASMB-785

ATX Workstation Motherboard Supporting Xeon E3-12XX v5/v6

PCIE-1674E

4-Port PCI Express GigE Vision Frame Grabber

System Description

Of particular importance, the system had to be designed to support in-house software for visual analysis of acquired images. The IPC configuration was an ASMB-785 mainboard housed in an IPC-7130 chassis and fitted with a Xeon® E3 CPU. Each IPC had up to three PCIE-1674E PCIe cards, providing PoE for connecting up to 12 cameras for alignment monitoring and workpiece inspection. This design aspect further contributed to the compact design of the system.

System Diagram

Why Advantech?

In addition to our position as the world's leading IPC manufacturer being a critical consideration in the customer's decision to adopt our system, our IPCs had already been verified by their R&D team and our extensive experience in this field enabled us to immediately offer them a total solution.

Furthermore, by adopting a system from a single manufacturer, the customer had high confidence in the system's compatibility and reliability. We were able to leverage our partnership with a channel partner in Vietnam to provide local technical and RMA services, which was a major factor for the customer's choice of IPC because of its impact in reducing maintenance costs.

Additionally, because of Advantech's aggressive support in maintaining inventory and immediate cooperation for CTOS, we were confident in being able to respond to their tight delivery deadline. For the bottom line, this compact system benefited the customer by providing a stable, high-performance machine at a reasonable price.

Advantech's Multi-Axis Mechanical Arm Control Proposal

Location: **Taiwan**

Background

The enterprise is a leading vendor in high-speed PCB. The automated machinery market has begun to introduce Advantech's high-speed motion modules and integrated visual inspection proposal to meet the growing need to upgrade to automated machinery in following market trend of Industry 4.0. Coupling this technology with secondary development platforms not only enhances the equipment's own operation efficiency but also ensure seamless connection via successful program development, thus solving the typical difficulties involved in multiple system integration and forming a cohesive manufacturing system that is both smart and efficient.

System Requirements

Prior to implementing any upgrades, the enterprise had been developing a controller proposal for over 10 years; however, the system control and function sensitivity had already reached a bottleneck. This was compounded by constant improvements in automated equipment in the industry, which, although offering higher precision and speed control for control systems, had created an ongoing task for integrated mechanical arm solution providers.

The enterprise aimed to redesign a control system, with the objective of at least doubling the original speed without having to extensively modify existing equipment or the control system structure.

Additionally, they sought to easily interface different motor components and integrate visual inspection in order to accommodate future IoT connectivity development opportunities.

Project Implementation

MVP-3245

4-Axis Embedded Motion Controller with 32-ch Digital I/O

QCAM-GM2500

Mega Pixel PoE Industrial Camera

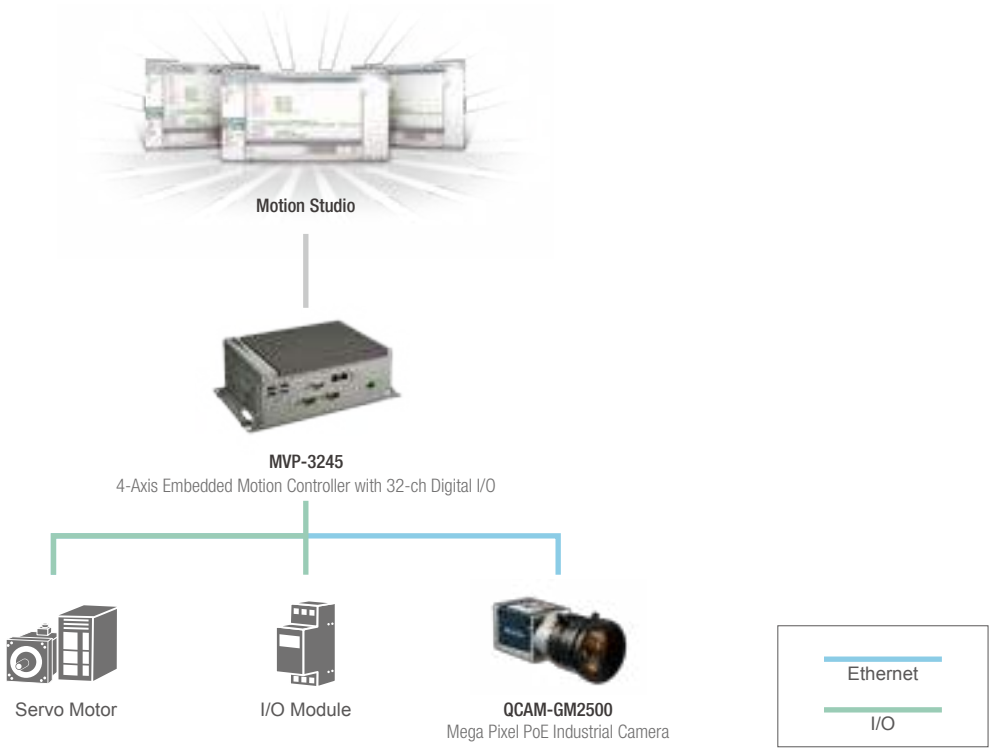
System Description

The MVP-3245 was employed as the interface between the Japanese P brand human–machine interface and Taiwanese/ Japanese system motor driver control. It was employed for system function setting, parameter adjustment, and equipment motion switching. Based on the Motion Studio post software development platform and soft motion control core, the MVP-3245 can realize precise real-time motion control applications in addition to delivering highly efficient development capabilities.

The complete system structure included the MVP-3245, human–machine interfaces, mechanical arms, and the corresponding controllers and camera modules. The MVP proposal enabled lateral connection of the three originally passive systems.

In addition to the value of integration, the derived data enabled the analysis of related program management and prediction of malfunctions, such that preventive diagnostics would be performed. Thus, the enterprise was accurately notified of not only which equipment required preventive maintenance or replacement but also when such actions were required, thus effectively achieving the goal of automated smart equipment.

System Diagram



Why Advantech?

For PCB-related industries, the high precision of Advantech's MVP-3245 programmable 4/8-axis controller can provide equipment vendors and system solution providers a simple and highly efficient programmable industrial management platform. This system allows traditional mechanical plants that use many traditional PLCs to integrate their system and implement Industry 4.0 practices in order to achieve complete integration, from monitoring surveillance to mechanical arm integration and system motor driver integration.

For users in the Network Computer market, Advantech provides basic commands for traditional coding, thus enabling enterprises to accelerate program development for post optimization. We can also provide exceptional compiling and execution speeds for various system structures in different fields.

An Internet Solution for PCB Equipment

Location: **Taiwan**

Background

Urgent and customized orders are recurring trends in the PCB industry. To shorten production times, it is necessary for production lines to be highly flexible while still satisfying customer quality control requirements. Common to traditional PCB factories are systems for solder paste printing, sampling, reflow soldering, and so on, all of which store relevant information for each corresponding station. Low-level equipment information, such as that from PCs, PLCs, and sensors, is typically not integrated, thus limiting maintenance and management processes that require production data, leaving manufacturers unable to promptly clarify the root of any issues that arise.

Smart productions systems provide a solution to this problem, and these can be realized only by establishing equipment connectivity. The obvious advantages of such systems are that the complete production history can be recorded and yield tracing can be conducted while integrating the data in the control room.

System Requirements

This customer had a complete PCB production line and corresponding equipment, with management and maintenance of each station based on manual inspections and the handwritten records of onsite personnel. Problems with connectivity had arisen due to production line expansion and increases in the amount of equipment at different times and equipment from different brands being unable to communicate effectively. This compounded the demands of visual inspections and made it more difficult to integrate low-level PLCs.

In some cases, despite the soldering process being the most important stage in maintaining PCB production yield, the customer had different generation soldering technology (e.g., wave soldering and reflow soldering equipment) operating at the same time, which made connectivity even more difficult. As a result, the customer sought a suitable proposal to achieve interconnectivity at the soldering stage. The short-term goal was to realize motor control and visual application integration as well as the real-time acquisition of data from PLCs, indicators, and PCB material input sensors. This datastream could then be monitored and integrated into the customer's existing enterprise database.

Project Implementation

ACP-4020

4U Short Depth Intelligent Rackmount Chassis

PCE-3029 / PCE-3B12-08

LGA 1151 6th / 7th Gen Intel® Core™ i7/i5/i3 Half-size SHB / PICMG 1.3 Half-size Mainstream SHB Backplanes

PCI-1202U / AMAX-1240

2-Port AMONet RS-485 PCI Master Card / Open Frame Type 4-axis AMONet Motion Slave Module

PCIE-1674E

4-Port PCI Express GigE Vision Frame Grabber

ADAM-6250 / ADAM-4570

15-ch Isolated Digital I/O Modbus TCP Module / 2-Port RS-232/422/485 Serial Device Server

System Description

Advantech's equipment interconnectivity proposal comprised four sections: 1) wave soldering/reflow soldering process data acquisition; 2) automated PCB movement and visual system integration; 3) equipment-end computing platform and local information integration; and 4) uplink data to the cloud and connect to a database.

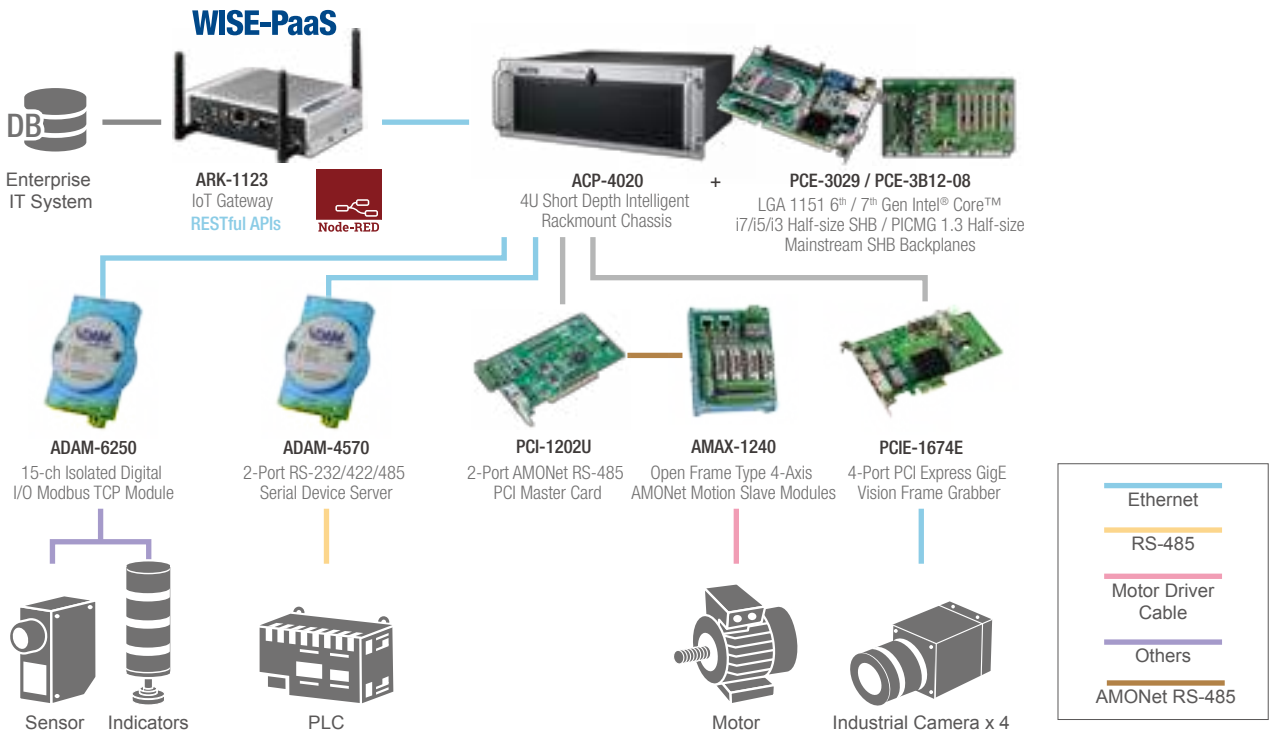
Data acquisition was achieved use the ADAM-6250 to acquire status records from spray sensors, flip machines, and the main equipment tower indicators (signals → TCP); and the ADAM-4570 to capture Mitsubishi PLC parameter data (RS-485 → TCP). Distributed movement and transport of PCB plates during paste soldering were achieved by connecting the equipment's driver/motor via a PCI-1202U/AMAX-1240 serial control module.

Additionally, visual location and image inspection were performed via PoE by utilizing a PCIE-1674E image acquisition card with data transferred to a ACP-4020 industrial computing platform for analysis.

Integration of local-end information obtained from the ADAM modules was enabled by installing the ACP-4020 industrial computer in the reflow smoldering equipment. The IPC also acted as the main control and visual computing platform, delivering orders to reposition PCB boards via the PCI-1202U/AMAX-1240, while simultaneously planning routes based on the image provide by the PCI-1674. Data uplink to the cloud was achieved using the ARK1123 IoT manager, which was connected to the ACP-4020. The system was developed using WISE-PAAS platform tools; specifically, WISE-Agent (for long-distance message acquisition), Node-RED Designer (for message management), and RESTful APIs (for data transformation).

Finally, the data were integrated with the customer's current enterprise databases.

System Diagram



Why Advantech?

This PCB equipment interconnectivity demonstrates the operation of Advantech's products as key components in each layer of the system, including data acquisition from the lower layers, transformation of various PLC data formats, and the distributed structure motor control and visual image acquisition; mid-layer computing platform and data integration; and the critical step of cloud data format management and enterprise database integration.

In addition to being mutually compatible, these layers were easy to develop. With particular regard to the computation layer, WISE-PAAS was invaluable in providing a flexible development platform, and Advantech's support in assisting with the development enabled the customer to work with each handler and the RESTful API data format, thus completing highly customized on-site information integration with the extant database.

The customer was able to complete a product demonstration in less than a year and then replicate this system in other mass production lines in Shanghai and Tianjin, thus increasing production efficiency via equipment interconnectivity.

Advantech's High-Speed Adhesive Dispenser Solution

Location: **Taiwan**

Background

In manual electronics manufacturing processes that require the application of adhesives, it generally takes double the effort to complete in comparison to when automated dispensers are used. When traditional adhesive dispensers are used, the process involves using contact-type dispensers to apply adhesives to such surfaces as electronic components and LED packaging.

However, with the miniaturization of products, these traditional dispensers can no longer be used. High-speed automated adhesive dispensers that provide accurate flow control as well as high-precision and contactless application are instead required for the forming of often micro-sized points, lines, and other shapes.

System Requirements

The customer required an automated adhesive dispensing system comprising pneumatic machines, image processors, I/O modules, and Internet communication control modules.

Industrial computers were needed to integrate motor drivers, adhesive dispenser controllers, and high-speed cameras. The dispensing system had to maintain stable adhesive control and trajectory planning. During operation, this not only includes controlling the pneumatic cylinder but also monitoring the environmental temperature and signals from various sensors. Once dispensing is completed, the system needed to confirm that the adhesive had been applied correctly to the surface via machine visual inspection.

Project Implementation

AIMC-3422

Micro Computer with Intel® Core™ i7/ i5/i3 Processor, Intel® H110 Chipset, 4 x Expansion Slots, and 300W 80PLUS PSU

PCI-1756

64-ch Isolated Digital I/O PCI Card

PCI-1245

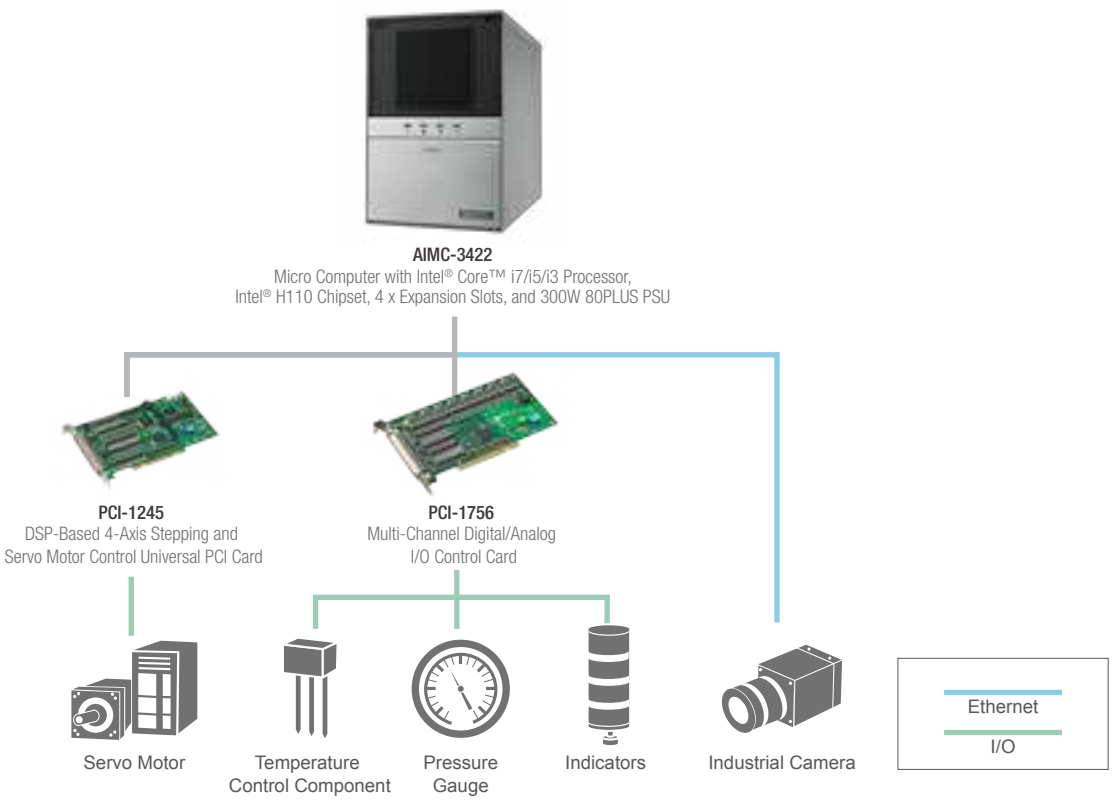
DSP-Based 4-Axis Stepping and Servo Motor Control Universal PCI Card

System Description

To ensure precise multi-task motion control and accurate image inspection, an AIMC-3422 Micro computer with Intel® Core™ i7/ i5/i3 processor, and a PCI-1756 high-speed I/O card was installed to connect to pneumatic components in order to control the electromagnetic valves and acquire signal data.

A PCI-1245 4-axis DSP-based motor control card was considered ideal for the server motor controllers because it has reserved memory for trajectory planning and a maximum pulse output of 5 Mpps. It also supports Advantech's Common Motion API, which enables the customization of trajectories with linear and arc functions while controlling the dispensing nozzles with PWM, thereby being able to set the output volume according to the nozzle cycle (referring to the time between opening and closing the nozzle). Intricate coating patterns could thus be achieved by controlling the distribution via speed limitations. Specifically, the dispenser valve and adhesive amount could be managed at jetting speeds of 100~200 Hz and the spacing could be controlled by adjusting the nozzle's movement speed.

System Diagram



Why Advantech?

Advantech was able to provide a total application solution for the customer's automated equipment, aided by our specialization in motion control systems, visual inspection systems, data acquisition, and industrial computers. For motion control solutions, we can develop customized functions that are specific to our customers' needs.

In addition to emphasizing the quality and stability of our industrial products as a professional brand, we also provide complete pre- and post-sales onsite service for our customers.

Automatic Vision Inspection Solution for Product Traceability in the Food and Beverage Industry

Location: **China**

Background

With greater market demand for food safety, traceability is receiving increasingly more attention in the food and beverage industry as well as the packaging industry.

Traceability refers to the ability to verify the history, location, and application of an item via documented recorded identification, thus enabling the recall of goods based on precise date/time and location information.

System Requirements

One of the world's leading providers of beverage containers required a system to identify bar codes and alphanumeric characters on ink-jet-printed labels at a run rate of 7 units and minimum 99.9% accuracy. Since there were few engineers in the factory, the customer sought to implement a reliable system with an easy-to-use GUI for workers with a less technical background.

Project Implementation

AIIS-3400P

Compact Vision System, Supports Intel® 6th / 7th generation Core i CPU, 4-ch Camera Interface for GigE PoE

QCAM-GM0640

0.3-MP Industrial Camera with PoE

Inspector Express

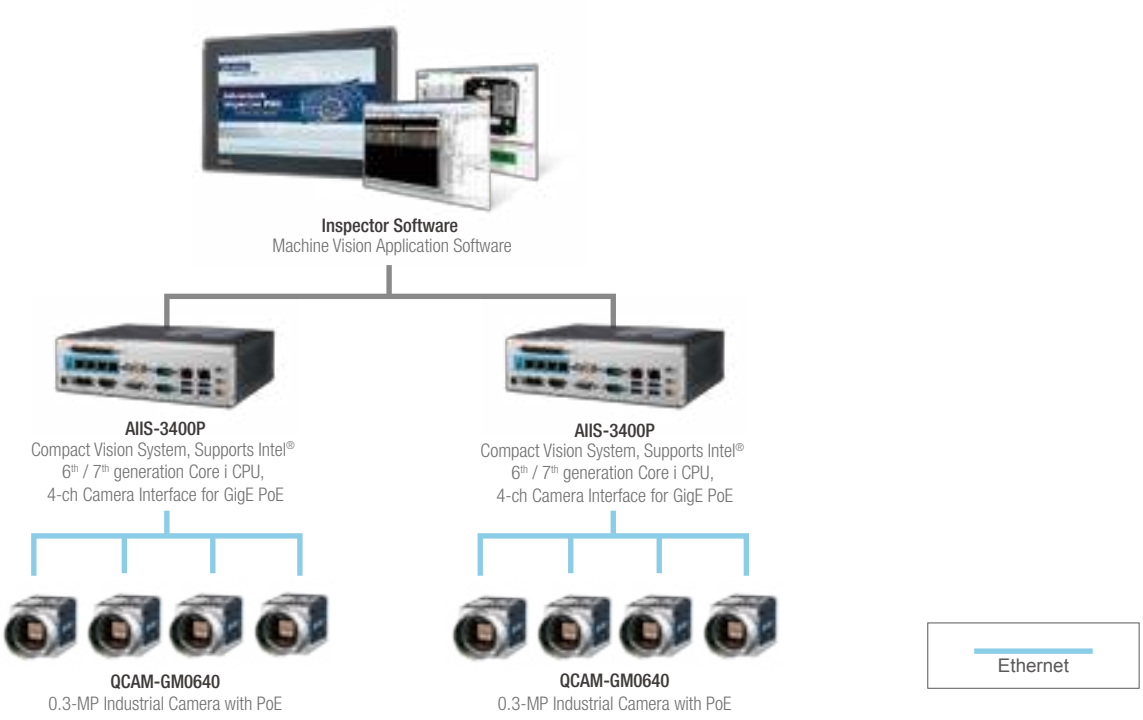
Machine Vision Application Software

System Description

Advantech provided a PC-based automated optical identification system with multiple cameras to identify bar codes, data codes, and characters on beverage containers.

The system included an AIIS-3400P 4-channel PoE compact vision system with an Intel® 6th / 7th generation Core i CPU; Inspector Express, a GUI machine vision application specifically designed for easy design and deployment of automated inspection on the factory floor; and QCAM-GM0640 0.3-MP industrial cameras with PoE for simple installation and maintenance.

System Diagram



Why Advantech?

Advantech Inspector Express facilitates building and deploying machine vision applications without any programming skills. It supports a wide range of Advantech industrial PCs, smart cameras, and embedded systems, and can be deployed on different hardware platforms without modification.

The AIIS-3400P's series' support of PoE combines power and signal supply into a single cable, and GigE Vision compliance and the system's compact size further simplify installation and maintenance.

A Solution for Screw Inspections

Location: **Taiwan**

Background

Developments and upgrades in electronics industries have coincided with an increase in the usage of electronic screws, which has led to greater demand for high-quality screws.

Due to electronic screws requiring comprehensive quality control checks for appearance, size, and quality, it is a time-consuming task and one that can cause fatigue to the human eye when performed manually—especially given their vast number and small size—resulting in low efficiency and human error. Replacing this task with an optical inspection solution is thus becoming a necessity.

System Requirements

The customer required screw inspection equipment that could acquire images and data to analyze whether the screws were being fabricated according to specification, all of which had to be performed in real time. The analysis results were then to be used to determine whether the screws had any defects. Defective screws were then to be routed to a screening device for removal, and the production timing and number of defects were to be recorded.

Project Implementation

MIC-7700 / MIC-75M13

Intel® 6th / 7th Generation Core i Desktop Compact Fanless System / 4-slot Expansion i-Module with 1 PCIe x16, 3 PCI

PCI-1274

Basic 4-Axis Motion Control Card with Multi-Latch/Comparative Trigger Function

PCI-1730

32-ch Isolated Digital I/O Universal PCI Card

PCIE-1674E

4-Port PCI Express GigE Vision Frame Grabber

QCAM-GC1300

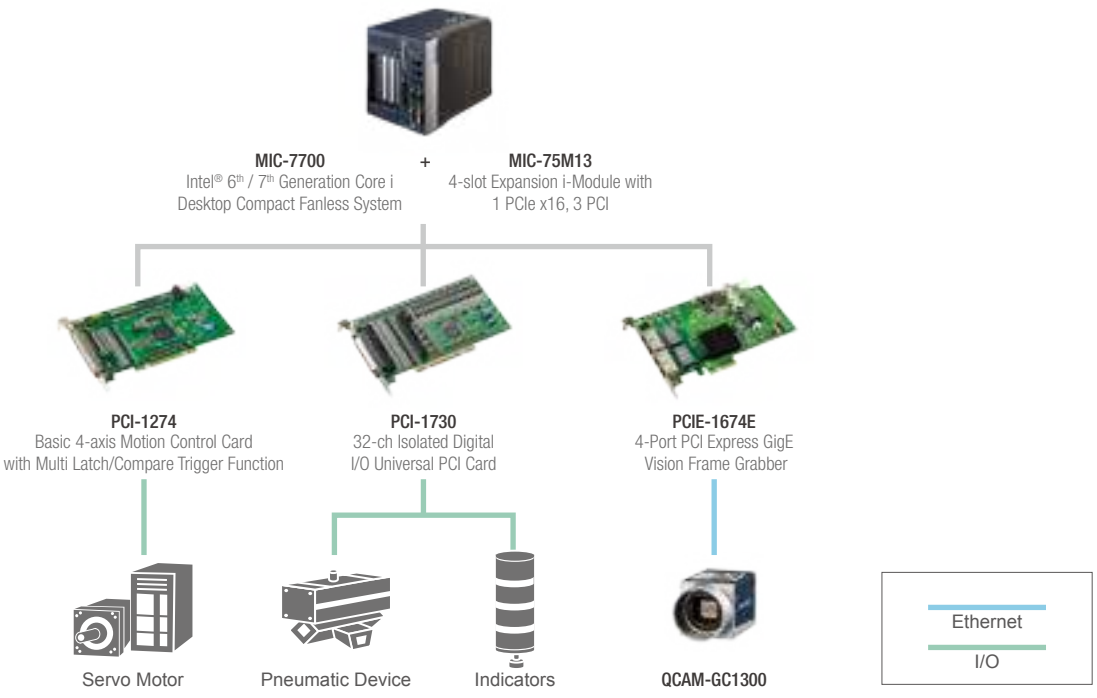
0.3~15-MP PoE Industrial Camera

System Description

The screw inspection platform was based on the modular IPC MIC-7700 with a MIC-75M13 4-slot expansion i-Module, the system was able to manage multi-tasking between precise motor control and high-accuracy visual inspections. Installed in the system was a PCI-1274 4-axis DCP-based motor control card for connecting to servo motors.

With support for Advantech's Common Motion API, this enabled the customer to utilize comparative trigger functions to efficiently plan for motor control. PCIE-1674E + QCAM GC1300 POE cards were also utilized to power the CCD cameras and retrieve image data. The PCI-1730 32-ch digital I/O card was also employed to connect the system to pneumatic devices and acquire signal data.

System Diagram



Why Advantech?

The PCI-1274's comparative trigger function cut costs for the customer by allowing them to shorten their program development time.

In addition to the benefit of adopting a total solution, this saved system integration time and accelerated the customer's development speed.

With our team of application engineers providing technological support, we were thus able to satisfy this customer's CCD needs.

Advantech's Solution for Aerospace Electronics Testing Systems

Location: **Taiwan**

Background

At the initial stage of airplane development, the various controls are first simulated using an aerospace electronics testing system. First confirming the switch logic and functions ensures that the system's control surfaces can be safely replicated in an actual flight cabin. This approach ensures that the controls will function as intended and is thus critical to flight safety.

Aeronautic electronics testing platforms feature a variety of control devices, dashboards, and signal displays, and are laid out identically to those found in actual aircraft, even with simulated flight instructions. These systems are then employed in professional flight simulation platforms, which are critical to pilot training because they provide a safe environment for becoming familiar with the controls without any human risk. Moreover, the cost of simulations is markedly lower than the cost of purchasing and flying an actual plane.

System Requirements

Cockpit controls are complex and intricate, with numerous digital and analog switches. The customer needed a system that was both reliable and flexible in order to handle varying requirements and the testing of multifunctional signals.

To ensure high stability, it was essential to have an industrial-grade PC with digital I/O, A/D conversion, and A/D signal data acquisition capabilities. Furthermore it had to be able to output analog and digital signals to control the automated knobs and digital switches.

Project Implementation

ACP-4340

4U Intelligent Rackmount Chassis with 4 Hot-Swap Drive Trays

PCE-5129/ PCE-5B12

PICMG 1.3 CPU card supporting 6th / 7th Generation Intel® Core™ i Processor/ 12-Slot BP for 14-Slot Chassis

PCI-1747U

250 kS/s, 16-bit, 64-ch Analog Input Universal PCI Card

PCI-1724U

14-bit, 32-ch Isolated Analog Output Universal PCI Card

PCI-1753

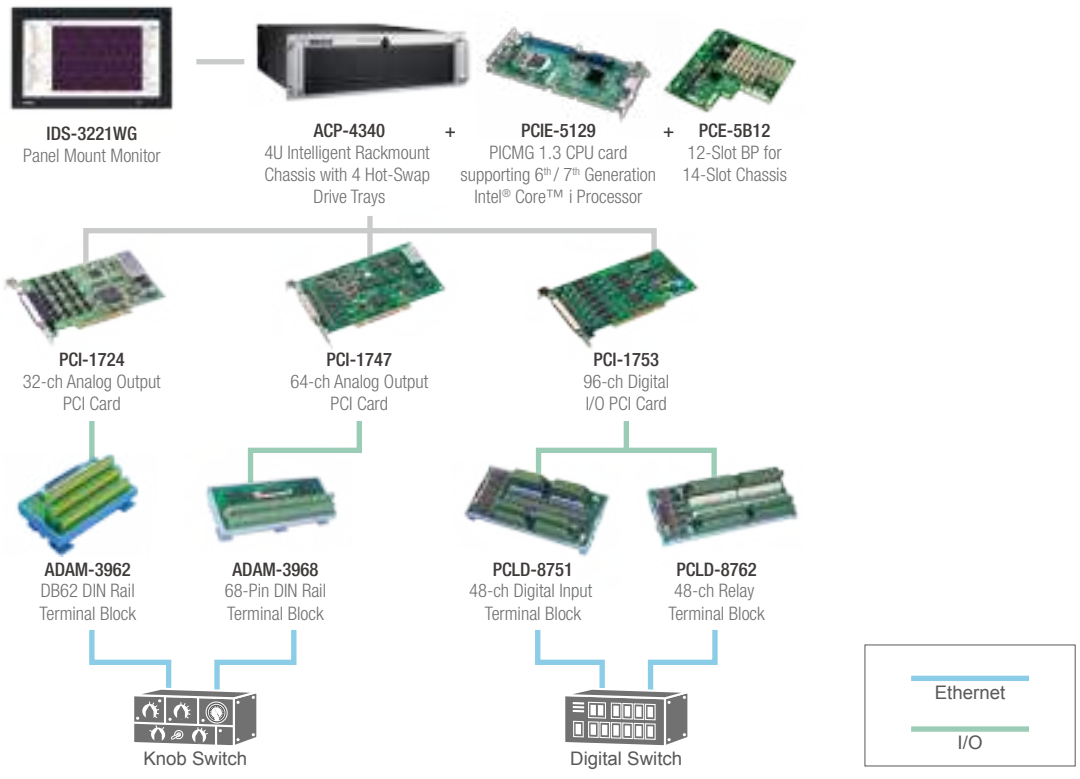
96-ch Digital I/O PCI Card

System Description

The system comprised an ACP-4340 rackmount chassis, PCE-5129 Intel® Core™ processor-based platform, PCE-5B12 12-slot backplane, and IDS-3221WG 21" monitor. It was fitted with a Core-i7 CPU to ensure high-performance multi-task processing between controlling the A/D switches and acquiring signal data. Adopting the PCE-5B12 ensured that the system could support a range of specifications, with PCI, PCIe, and PCI-X slots to satisfy the customer's various control cards, digital I/O modules, A/D converters, and data acquisition cards.

With Advantech's DAQNAVI SDK, the PCI-1747 64-ch analog input card, PCI -1724 32-ch analog output card, and PCI-1753 96-ch digital I/O card provided a powerfully rich interface to simulate the control surface, with the ISD-3221 utilized for the cockpit display.

System Diagram



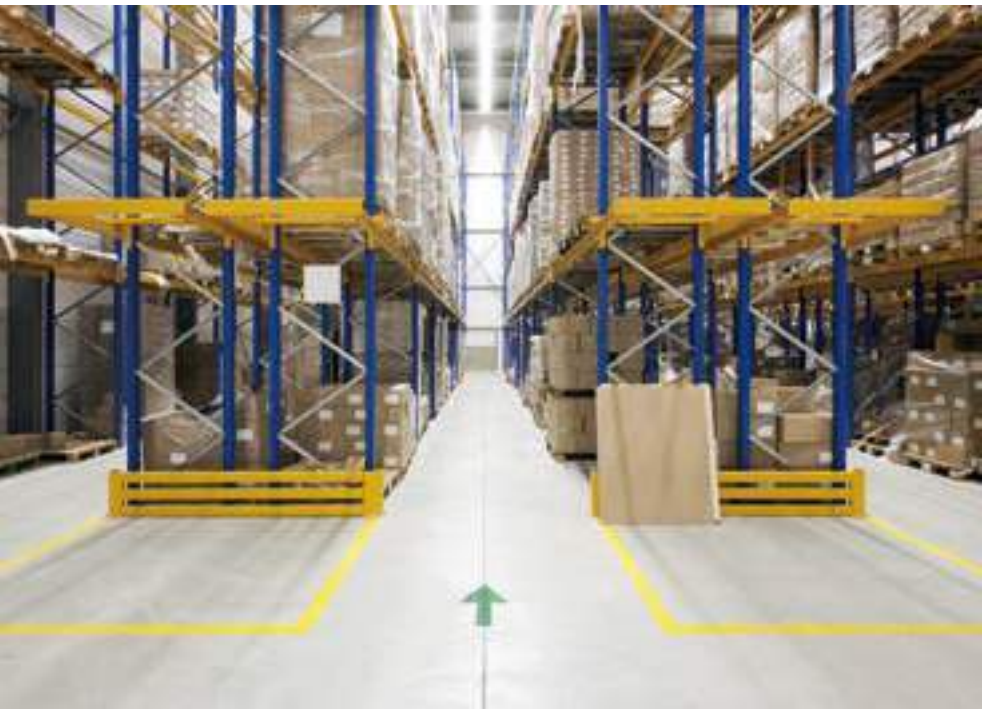
Why Advantech?

Aerospace applications have continued to expand with developments in basic electronics technology, particularly with aerospace systems being such a key component in aircraft development and pilot training. Modern aviation applications have thus emerged from the integration of advanced aerospace systems and onboard electronic equipment.

To satisfy this customer's multipurpose signal testing requirements, Advantech's stable and efficient platform as well as the flexible expansion options of the motherboard complemented the various card requirements, such as the need for multi-channel digital I/O, A/D conversion, and data acquisition cards. By utilizing Advantech's DAQNAVI software SDK, the customer is now able to rapidly develop aeronautics testing platforms to verify the dashboard logic control and functionality.

In addition, at the initial stage of dashboard development, the customer will not need to invest large sums of capital to obtain US/EU high-end measurement equipment signals. With the high price–performance ratio of Advantech's industrial calculator, the customer can attain reliable measurement control data at minimal cost.

Shop Till You Drop With Advantech's e-Commerce Warehouse Logistics Solution



Location: **China**

Background

This company is the largest e-commerce platform in the United States and is committed to continuous innovation with a customer-centric focus. To shorten shipment times and improve the customer experience, the company is currently seeking to update their warehouse logistics system in China.

Accordingly, numerous automated guided vehicles (AGVs) will be introduced into the new warehouse logistics system and, together with sorting personnel, will be able to conduct fast, efficient cargo sorting to reduce the time between product sorting and shipping.

System Requirements

The computers used by the customer in each sorting station were conventional wall-mount computers. The system upgrade and increase in cargo handling meant that personnel would require a system with multi-screen support; thus, the original computer configuration was no longer suitable. In addition, as is common with warehouse environments, the presence of dust is a known problem for computers because it invariably results in fan malfunctions, thus affecting heat management. Given the volume of orders received by this company, any workflow errors or interruptions due to equipment failure would be unacceptable.

Another key consideration was the massive data transmission requirements for processing the enormous amount of cargo.

Construction of a network environment that improved on the reliability and stability of the company's system was a critical issue. A key point of the new system was to ensure that each sorting station could be linked together while providing continuous data transmission in order to construct the most reliable transmission backbone network to meet the needs of modern warehouse logistics.

The two major system requirements were thus 1) high-performance, fanless, small-sized desktop industrial computers and 2) a stable and reliable wired/wireless network.

Project Implementation

MIC-7700

Intel® 6th/7th Generation Core I Desktop Compact Fanless System

EKI-7710

8FE+2G Combo Managed Ethernet Switch

EKI-6332

IEEE 802.11b/g/n Wi-Fi Access Point/Client

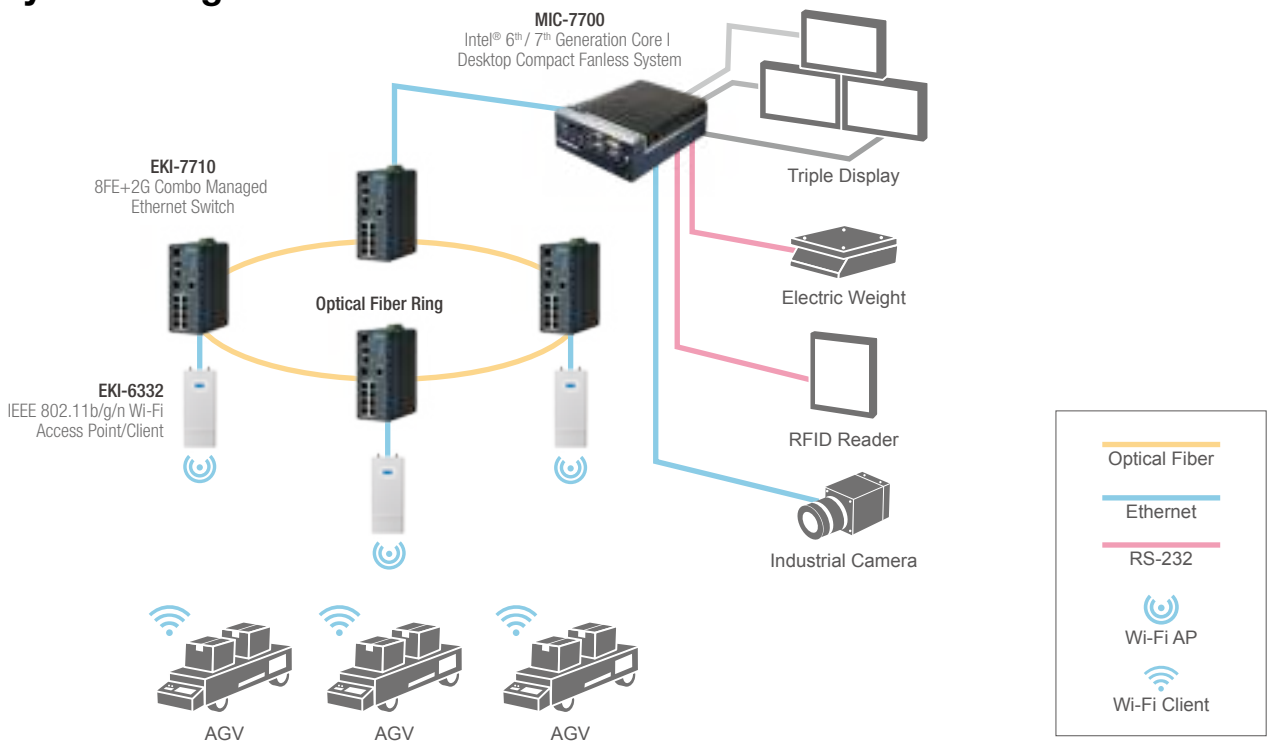
System Description

Advantech recommended the MIC-7700 as the core for the overall warehouse logistics system. This fanless system was to be used at each sorting station, providing a high-performance CPU that would more than satisfy the company's computing requirement while eliminating problems caused by dust. The MIC-7700 is a low-cost option that supports desktop processors while ensuring high performance. Its compact structure and single-side I/O design facilitates quick installation and subsequent maintenance. Advantech's own MIC-Door iDoor design reserves I/O space with a scalable i-Module design for at least 20 PCIe buses (1~4 slots), 9~36 V power voltage, and functions environments where temperatures are in the range of -10~50°C.

For the network architecture, we recommended utilizing the EKI-7710 industrial-grade managed Ethernet switch as the overall backbone network. Given the sheer amount of equipment in the whole warehouse (e.g., metal cargo shelves, logistic transport belts, and automated cranes), standard business switches—although low-cost—would be unable provide a reliable and stable network environment. Furthermore, with the large volumes of data requiring upload, any interruptions could potentially result in major problems for the entire sorting process. As an effective countermeasure, a fiber optic loop network with the EKI-7710 was adopted to eliminate this possibility.

Because the warehouse logistics system utilized many AGVs that are controlled wirelessly, establishing reliable wireless environment coverage was critical in order facilitate their operation. For this, the EKI-6332 industrial-grade 2.4G wireless access point was adopted for wireless coverage of the whole site. This unit provides a high level of interference resistance and, through its connection with the EKI-7710, extended the entire network environment from a wired configuration to a wireless one. With this system, all AGV control orders are given from each MIC-7700, passed through the EKI-7710, and then wirelessly transmitted to the AGV via the EKI-6332. The AGV accordingly moves the cargo shelves to the target sorting station as instructed. Hence, the implementation of Advantech's solution provided a complete, stable, and reliable network architecture.

System Diagram



Why Advantech?

Advantech's comprehensive solution was a successful upgrade for the customer's warehouse logistics system, effectively improving the efficiency of cargo sorting, shortening the time from product collection to sorting and then shipment, and minimizing shipment errors, thus ensuring improved customer satisfaction.

Intelligent Parking System Powered by PC-Based AGV Parking Robot

Shenzhen: **China**

Background

Automated guided vehicle (AGVs) are most often used in industrial applications to transport materials around a manufacturing facility or warehouse. In today's era of the industrial Internet of Things, factories are not only undergoing a fourth industrial revolution, but AGVs are also shifting from automation toward intelligentization, with applications expanding from the factory to the parking lot. Using a Wi-Fi module, laser navigation, and comb-exchange technology, an AGV manufacturer has created an intelligent parking robot that can lift and park a car in just 120 seconds.

To ensure the parking robot can accurately receive tasks from the centralized dispatch system and execute commands without collision or accident, a palm-sized, fanless, in-vehicle x86 industrial communication gateways was incorporated.In the past, AGVs were typically controlled and operated using a programmable logic controller (PLC). However, parking AGVs must perform multiple arithmetic operations to ensure comprehensive monitoring, for which PLCs offer inadequate speed and function.

System Requirements

The client has developed parking, logistics, and e-commerce AGVs for various application fields by leveraging the experience of their parent company in developing and manufacturing 3D garage parking systems. Recently, the company revised its parking AGVs by replacing the original controller with a more cost-effective gateway in order to harness key technology and increase market penetration.

Featuring two guidance modes (laser and magnetic tack), the client's new comb-type intelligent parking AGV can automatically move forward/backwards, turn left/right/around, spin, and perform plane translation and differential drive. However, because of the AGV body's limited dimensions, minimal space is available for essential hardware devices. Therefore, the AGV control gateway must be capable of performing complex movement calculations and sufficiently compact to be embedded into long plate vehicles while also featuring vibration, shock, and collision protection.

Additionally, the intelligent AGV parking system must be capable of managing over one hundred vehicles simultaneously. Thus, remote device monitoring software is required to ensure that the central control room remains aware of the real-time vehicle status. Furthermore, early warning capabilities that allow managers to arrange vehicle maintenance in advance are essential to ensure the continued dispatch of intelligent parking AGVs in the parking lot.

Project Implementation

UNO-2272G

Intel® Atom™ J1900 Processor, up to 2.41 GHz, with 2 GB of DDR3L Memory

PCM-24S2WF

iDOOR Module: Wi-Fi 802.11a/b/g/n 2T2R w/ Bluetooth 4.0, Half-Size mPCIe, Antennas

PCM-26D2CA

iDOOR module: 2-Port Isolated CANbus mPCIe, CANopen, DB9

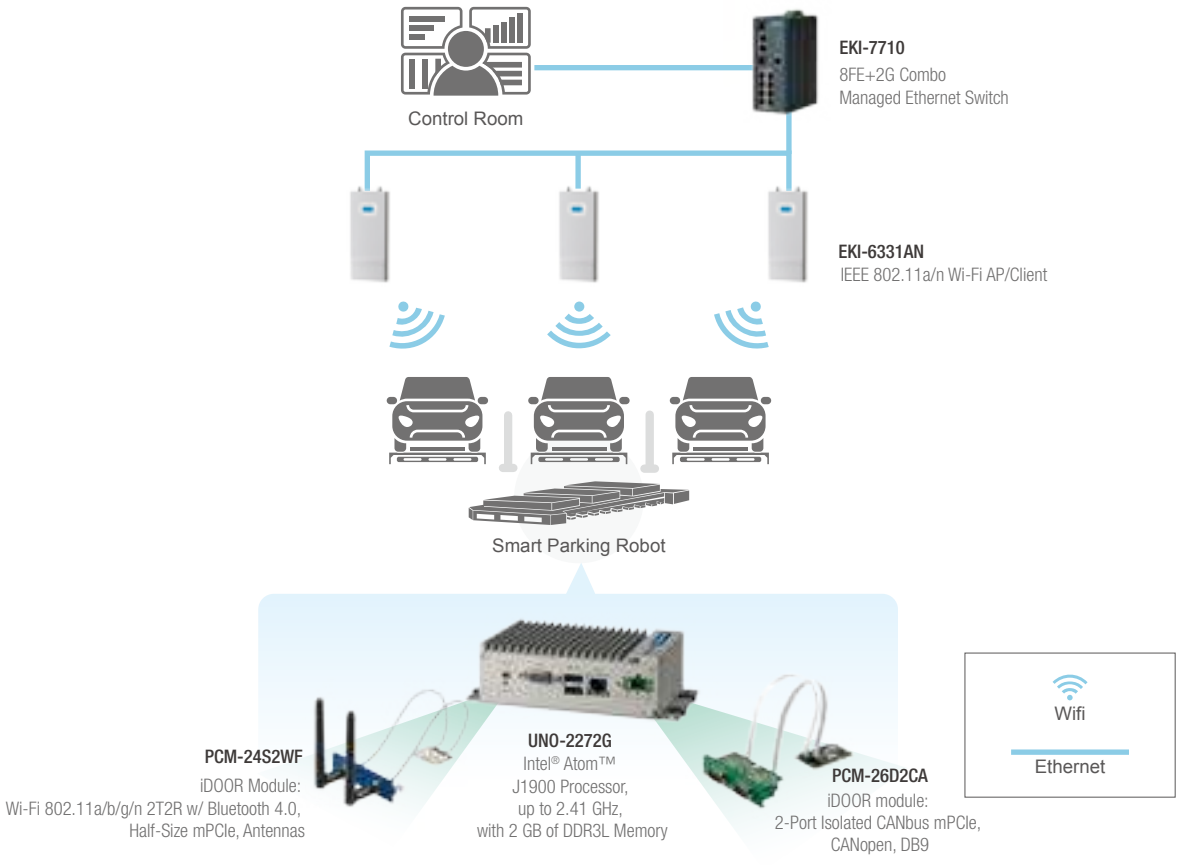
System Description

Featuring an Intel® Atom™ J1900 processor, wireless communication module (PCM-24S2WF), and CANbus module (PCM-26D2CA), Advantech's palm-sized communication gateway, UNO-2272G, is capable of not only receiving commands from the central dispatch system, but also processing data collected from the anti-collision sensor, 360-degree laser transmitter, and magnetic nail scanner to calculate the parking location and travel path, and then instructing parking AGVs to autonomously transport vehicles to specific parking spaces.

Regarding ruggedness and reliability, the system's lightweight aluminum enclosure enhances heat dissipation and protects the components and modules from damage due to water or dust ingress. The durable built-in mSATA solid-state hard drive offers increased read/write speeds. Furthermore, UNO-2272G has been certified according to IEC standards for shock and vibration tolerance to ensure continued and reliable operation in extreme environments.

Although the primary objective of this project was to supply hardware for an intelligent AGV parking system, Advantech also offered added value with its software, which included custom drivers for Wi-Fi and CANbus modules and remote device monitoring software.

System Diagram



Why Advantech?

Advantech's PC-based embedded automation computer UNO-2272G equipped with two iDOOR modules (Wi-Fi communication and CANopen fieldbus protocol) not only fulfills the performance requirements of parking AGVs, but also supports componentized real-time operating systems (Windows Embedded Compact 7), customized drivers, and remote management and monitoring software (WISE-PaaS/RMM). These features provide AGV robots with additional capabilities, such as instruction issuing, travel track and position monitoring, system health diagnosis, and automatic scheduling.

The client's intelligent AGV parking robot featuring Advantech's UNO-2272G communication gateway can generate a massive 40% more parking spaces in congested areas due to its accuracy and help drivers to find a space and slots in just 120 seconds!

Currently undergoing testing, the client's new system is set for deployment at its Nanjing parking lot in 2017. Meanwhile, the company will continue to adopt Advantech products and develop AGVs for other application fields.

Data Acquisition Solution with a High Price-Performance Ratio for Distributed Temperature Sensor Systems

Location: **China**

Background

Rather than using temperature sensors to monitor temperature, distributed temperature sensor (DTS) monitoring systems use optical fibers as temperature sensing devices. With temperature sensing optical fiber cables installed in the monitored area and connected to a host computer, measurement software can be used to display real-time temperature changes. Benefiting from the advantages of optical fibers, which include being unaffected by electromagnetic interference, freely bendable, small and easy to install, and able to support detection in large areas without blind spots, DTS systems are especially suitable for high-risk, disaster-prevention applications, such as power cables, oil/gas pipelines and storage tanks, and highway/railway tunnels.

The quality of DTS systems is determined by the system's ability to quickly and accurately continuously monitor the temperature of all sites along the cable. For system integrators, the optimal data acquisition (DAQ) product must be selected during development to ensure that the system performance meets market requirements and exceeds that of their competitors.

System Requirements

The company's DTS system comprises a DTS host machine, temperature sensing optical fiber cables, measurement software, and related products. Spatial temperature distribution information is obtained using the Raman effect of light transmitted in optical fibers and an optical time domain reflectometer (OTDR). Because the company's original DTS host, a DAQ-equipped personal computer, lacked sufficient speed and resolution, the company wanted to replace this hardware with a high-performance computer and high-speed digitizer to improve data collection accuracy and system

However, the new hardware needed to offer a high performance. price-performance ratio. Specifically, the digitizer needed to support a sampling rate of no less than 100MSPS, 16-bit resolution, simultaneous analog sampling, data transfers through direct memory access (DMA) for faster processing, and large onboard memory to ensure efficiency.

Regarding the computer, the client required a system equipped with a high-performance processor, multiple PCIe slots, and a storage device with fast read/write speeds, as well as suitable protection to withstand industrial usage.

Project Implementation

PCIE-1840

16-Bit, 4-Ch, High-Speed (up to 125/80 MSPS) DSA Card

AiMC-3201

Micro Computer with Intel® Core™ i7/i5/i3 CPU, 2 x Expansion Ports (PCIe), and 250W 80Plus PSU

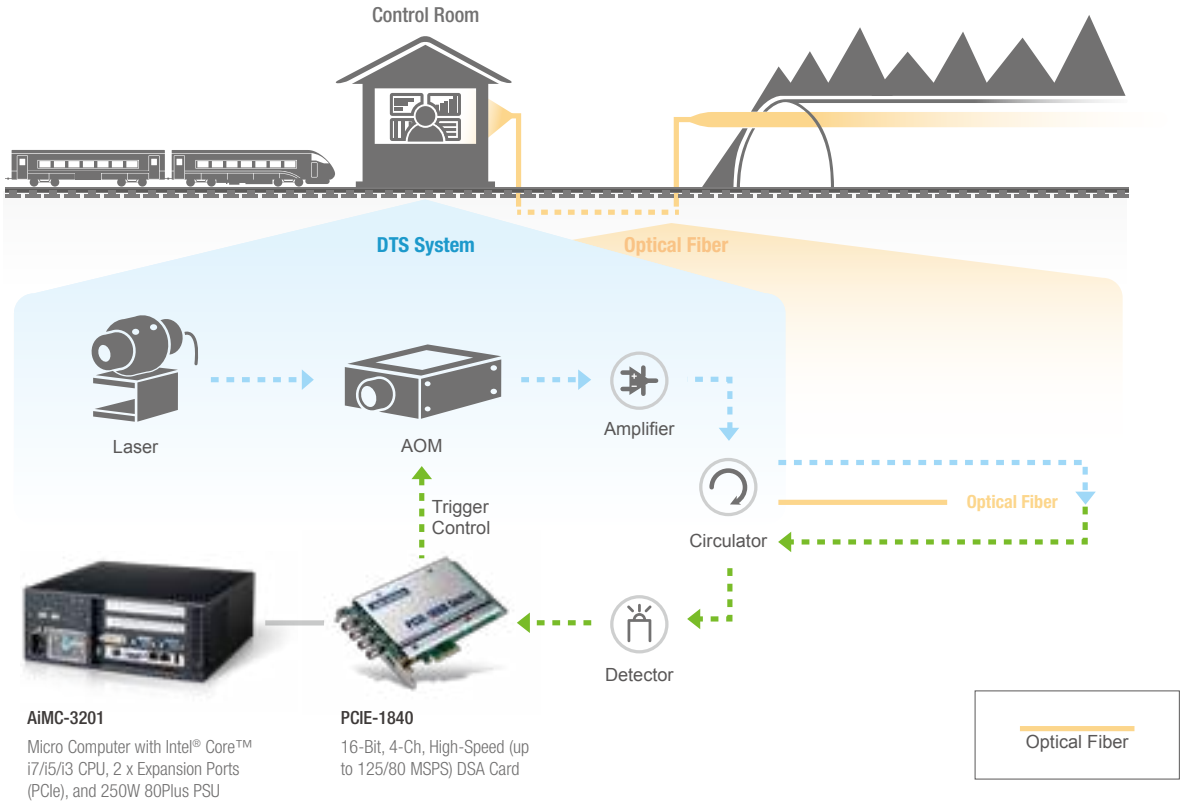
System Description

Advantech's DAQ solution includes an AiMC-3201 microcomputer and a PCIE-1840-AE digitizer. Characterized by a wide dynamic range and high sampling rate, the system is extremely suitable for use as an optical fiber temperature sensor host that enables the DTS system to acquire high-frequency signals.

By perfectly integrating the two products, the DAQ system is capable of triggering acousto-optic modulators (AOMs) that control lasers to send a laser pulse of set width to the propagator and then to the optical fiber cable, while also receiving the backscattered signal of the laser pulse source from the photo transducer. After processing on the host computer, the signal shows the temperature distribution for the entire temperature sensing cable. The PCIE-1840-AE digitizer is the most important component of the solution because it is this hardware that simultaneously triggers transmissions of the laser pulse while receiving the backscattered signal. This digitizer, with its sampling rate of up to 125 MSPS, 16-bit resolution, and four simultaneous analog input channels, enables precise and speedy data collection. Moreover, the inclusion of 2 GB of onboard memory satisfies the requirements for high-speed data transmissions. Data transmissions through CPU-independent DMA accelerate the overall transmission rate and reduce CPU load.

To further accelerate DMA data transmissions, Advantech adjusted the driver for this project by enhancing the transmission rate more than tenfold. In addition, because the strength of the laser beam is determined by the width of the laser pulse, Advantech customized the PCIE-1840-AE board with a field-programmable gate array (FPGA) to assist users with setting the pulse width.

System Diagram



Why Advantech?

The high sampling rate, resolution, number of channels, transmission speeds, and onboard memory of Advantech's high-speed digitizer PCIE-1840-AE exceeds that of conventional DAQ models and low-level digitizers.

The performance of the client's DTS system increased with the inclusion of the AiMC-3201 high-performance microcomputer.

Advantech also customized the PCIE-1840-AE board according to their specific needs to significantly improve the overall system efficiency.

Finally, because of the positive results of introducing Advantech's DAQ solution, the client company has decided to copy this solution with other systems.

Advantech's Digitizer Provides an Effective Solution for PCB Laser Drill Pulse Signal Measurement

Location: **China**

Background

As electronic products require larger numbers and more intricate arrangement of electronic components on printed circuit boards (PCBs), the PCB development trend of high density wiring has brought about innovations and advances in drilling technology. Of these innovations, the non-contact laser process, requiring no blades, has become an important process instrument for high density PCB manufacturing. Besides precluding problems such as blade blunting and chipping, its pros include better performance on hole diameter accuracy, process speed, and quality consistency.

For PCB laser drills that are required to shoot many laser pulses per minute as "drill bits," the laser pulses must maintain a consistent waveform for the laser beam to make neat holes of the same shape and size. Therefore, to clearly acknowledge any variations in the waveform of this highly repetitive laser pulse application, IPC controlled devices are usually paired with a monitored laser pulse waveform measurement system to ensure drilling quality.

System Requirements

A Shenzhen high-tech company specializing in the development of laser equipment especially for the PCB industry offers equipment for PCB precise drilling and milling. The equipment manufacturer has always set high standards for their product quality, although they have been providing laser pulse monitoring features with their equipment long ago, the company would like to offer PCB laser equipment with higher efficiency, high precision, high stability, and low operation costs to take their products to the next level.

So they decided to replace the existing digitizers, which are only 14-bit resolution, costly, and non customizable, and first use CO2 laser drills as demonstration units, introducing the measurement system to other laser equipment later, while at the same time preparing for future offers of preventative maintenance services through relative collected information.

The new digitizer must be a product of high price-performance ratio, and be able to collect pulse signals with high speed as well as perform specialized computing (e.g., data accumulation, comparison with preset values, etc.) Therefore, besides the product itself providing at least 16-bit resolution and 100MS/s sampling rate, customized services should be available as per the company's requirements to help them undergo redevelopment more easily to complete new features faster and introduce the laser drill to the market as soon as possible.

Project Implementation

IPC-7120

Desktop/Wall Mount Chassis with Front I/O Interfaces for ATX/mATX Motherboards

AIMB-784

LGA1150 4th Generation Intel® Core™ i7/i5/i3/ Pentium ATX with DVI/VGA, DDR3, and SATA III

PCIE-1840

16-Bit, 4-Ch, High-Speed (up to 125/80 MSPS) DSA Card

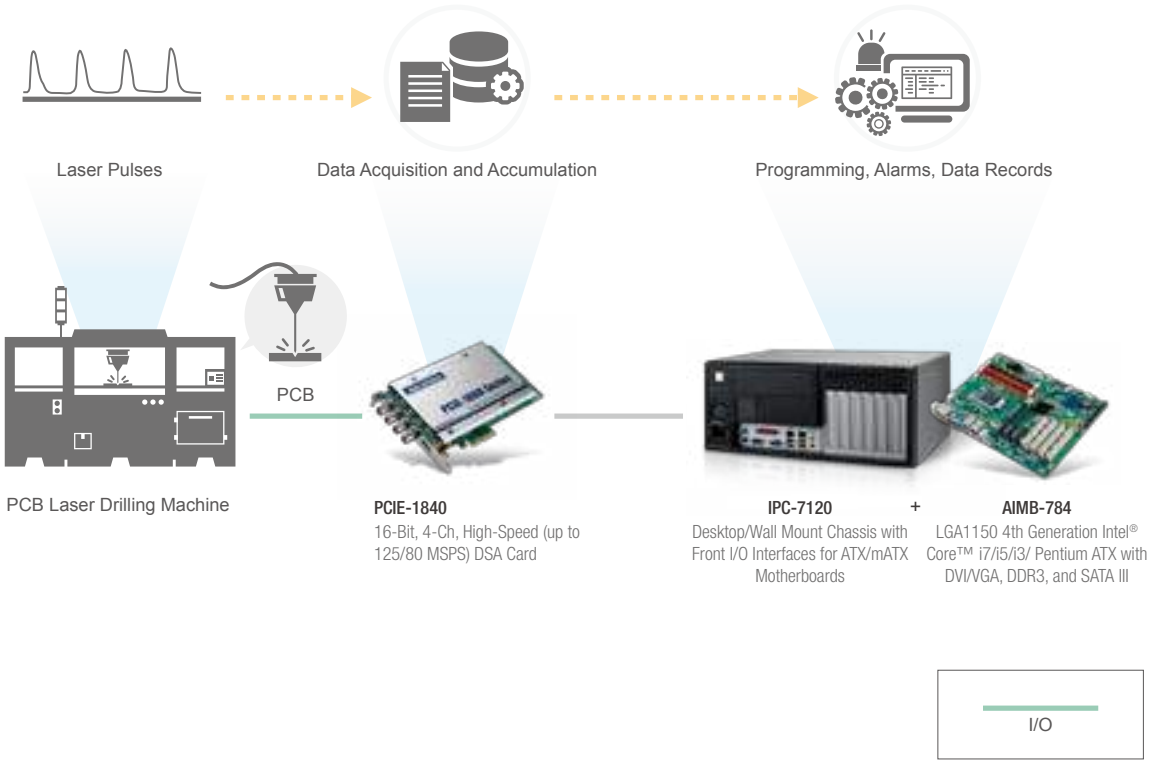
System Description

Advantech's laser pulse signal measurement solution includes a PCIE-1840 high speed digitizer for precise laser pulse signal collection, a customized FPGA for performing specialized computing, and a customized Windows driver for simple redevelopment.

The complete operation process for this solution is: First, set the laser pulse signal acquisition start point, acquisition stop point, and standard and error values via the customized Windows driver. Following set up, the PCIE-1840 installed in the IPC can automatically capture pulse signals. The collected data is accumulated on the FPGA embedded in the PCIE-1840 (similar to integration), and then the sum is compared with the preset standard and error values. Finally the analysis results are transmitted to the IPC. If the results are within the preset values, the data will be stored in the IPC hard disk for future tracking and searching. If the results are out of the preset range, a variation in the laser pulse is implied, and based on this data the IPC can send out a warning or perform emergency processes such as shutdown.

In contrast to the digitizers used by the laser equipment manufacturer before, the 4-channel PCIE-1840 increases the precision of laser drills fourfold with its 16-bit high resolution, and the 125 MS/s simultaneous sampling enables high speed continuous data acquisition. So for laser pulse signal measurement applications requiring high performance digitizers, the PCIE-1840 is a quality product with super high performance and a comparably reasonable cost.

System Diagram



Why Advantech?

The digitizer is an indispensable pulse signal acquisition tool for laser drill pulse measurement system development. The digitizer's resolution and sampling rate determines whether the high speed and precise data acquisition requirements of the equipment are satisfied. Advantech's PCIE-1840 is the world's first PCIEx4, 125MSPS, 16-bit, 4-channel digitizer, extremely suitable for applications requiring high speed pulse signal collection, including laser drills.

At the same time, Advantech's highly experienced professional technological team is happy to develop innovative features together with clients. For this project, the customized FPGA and driver required were both able to quickly address the various problems met by the laser equipment manufacturer through prompt responses and fluid communications with Advantech.

Thanks to Advantech's high performance and economical PCIE-1840, the company's CO2 laser drill has effectively increased production yield and reduced scrapping rate, and the same laser pulse measurement solution will be gradually introduced to other models in the future.

Greater China

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