

APLIKASI-APLIKASI DCS DAN PENGEMBANGANNYA

Pengenalan

Sejak tahun 1970-an, industri manufaktur masuk ke dalam periode penggunaan CIMS (computer integration manufacture system - sistem manufaktur dengan menggunakan komputer terintegrasi). Aplikasi CIMS bertujuan untuk mendistribusikan banyak operasi kontrol dan pengintegrasian informasi dari banyak fasilitas lapangan. Selama pengembangan 20 tahun terakhir, terdapat beberapa periode aplikasi penggunaan tipe-tipe DCS. Dari DCS dan FCS ke ICMMS, unit kontrol terus meningkat kecerdasannya dan kemudahan desain metoda kontrol terus meningkat.

1. DCS

DCS adalah suatu teknologi kontrol baru yang menggunakan teknologi komputer untuk memonitor, beroperasi, mengatur dan mendistribusikan banyak unit kontrol. Dengan aplikasi DCS, permasalahan keterbatasan jarak pendistribusian unit kontrol dan pengintegrasian semua sistem kontrol berkomputer pada sistem manufaktur (industri) menjadi permasalahan yang mudah diselesaikan.

Struktur sistem DCS secara umum dapat dibagi menjadi beberapa tingkatan vertikal: process control level, control manage level dan producing manage level. Masing-masing tingkatan dapat dibagi secara horisontal menjadi berbagai macam komponen. Karakter umum dari DCS sendiri adalah sebagai berikut:

- a. memproduksi sistem yang mampu bekerja sendiri,
- b. penyelarasan kerja terintegrasi,
- c. on-line dan real-time,
- d. keandalan tinggi,
- e. kemampuan beradaptasi, tangkas dan scalability,
- f. cost effective.

2. Field Bus

Field Bus secara umum digunakan untuk melakukan efektifitas dalam komunikasi jaringan semua komponen DCS. Adanya Field Bus mengubah wajah DCS, menjadi suatu sistem kontrol yang benar-benar terdistribusi, dengan mengimplementasikan fungsi kontrol langsung dekat dengan operasi dengan menggunakan fasilitas-fasilitas pengolah sistem kontrol yang cerdas di lapangan secara terdistribusi.

Dengan adanya teknologi field bus ini, mengubah teknologi DCS menjadi FCS. Perubahan yang sangat mendasar adalah dengan membagi control station menjadi beberapa bagian yang didistribusikan ke berbagai area, dimana dengan melakukan distribusi ini akan mengurangi beban control station pusat.

3. ICMMS

ICMMS (Intelligent Control Maintenance and Technical Management System) adalah suatu teknologi dalam upaya sistem manufaktur untuk meningkatkan capability, reliability, dan profit. ICMMS didasarkan pada IAMS (Distributed Intelligent Actuation and Measurement System) yang diintegrasikan dengan CMMS (Control Maintenance and Technical Management System).

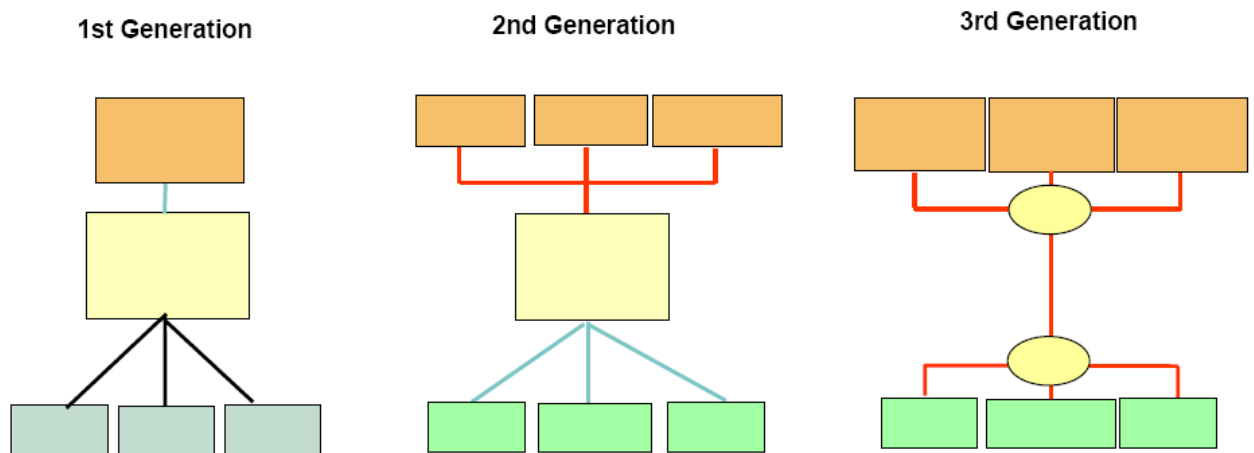
Dalam konstruksi sistem ICMMS, sistem kontrol, subsistem manajemen teknologi dan pemeliharaan tersusun atas workstation yang saling berhubungan dan susunan serial sub-function yang saling bersesuaian pula. CMMS adalah sistem yang mengintegrasikan manajemen dan pemeliharaan sistem kontrol sebagai keseluruhan sistem.

4. Pengembangan Baru DCS

Kecerdasan dari modul-modul yang ada di dalam IAMS mencerminkan kecenderungan pengembangan kecerdasan pada subsistem kontrol. Pada sistem DCS modern, sensor dan actuator bukan lagi hanya sekedar informasi sederhana dari lapangan dan sekedar fasilitas kontrol sederhana saja. Mereka mempunyai otonomi terbatas dan kemampuan sederhana dalam belajar,

komunikasi dan melakukan kerjasama internal maupun eksternal sendiri. Dalam hal ini mereka bekerja sebagai agen (unit terpisah yang bisa bekerja sendiri namun masih dalam satu kesatuan sistem menyeluruh).

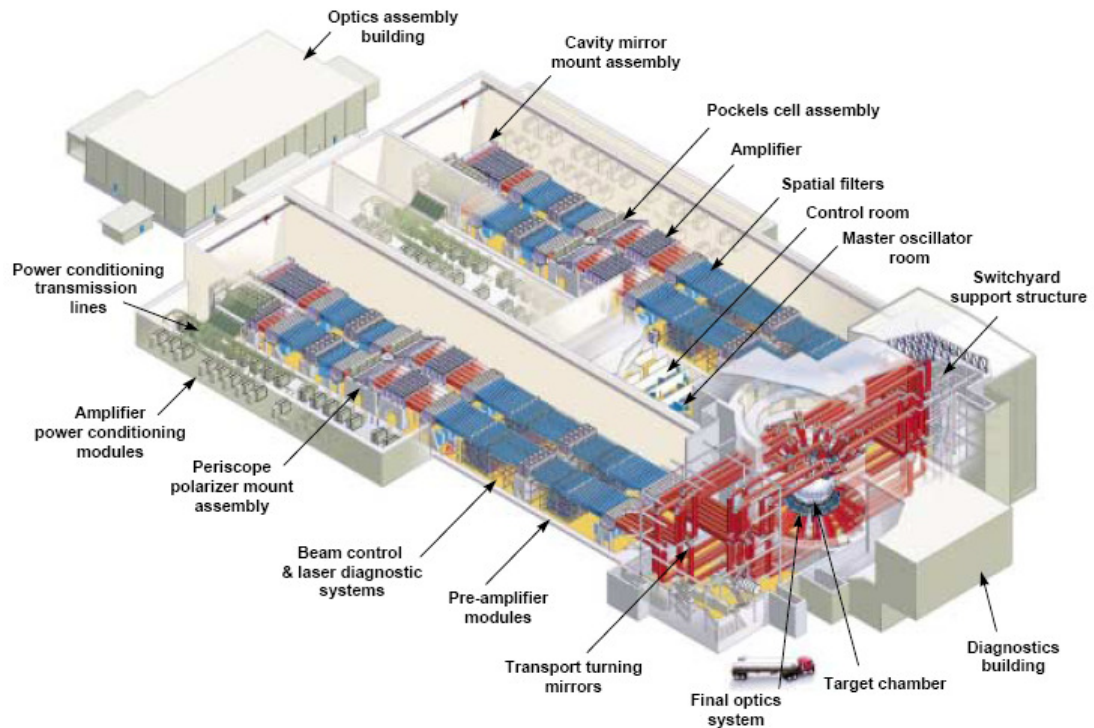
Dengan mengembangkan kumpulan sensor dan aktuator menjadi agen, maka akan tercapai suatu sistem yang bekerja dengan efisiensi tinggi dan sangat kompak (melakukan kerjasama dengan sangat baik). Kekompakan kerja dari tiap subsistem ini menjadi subyek permasalahan yang baru. Hal ini biasanya diselesaikan dengan penggunaan efisiensi CSCW (Computer Supported Cooperative Work) atau groupware. Pada CSCW sistem, transaksi (alur data dan proses kontrol) diproses oleh agen. Efektifitasnya tergantung dari desain agen dan penempatan agen-agen tersebut dalam keseluruhan sistem.



Beberapa Contoh Aplikasi DCS

1. Distributed Control System for the National Ignition Facility

The National Ignition Facility is a high-energy laser for inertial confinement fusion research.

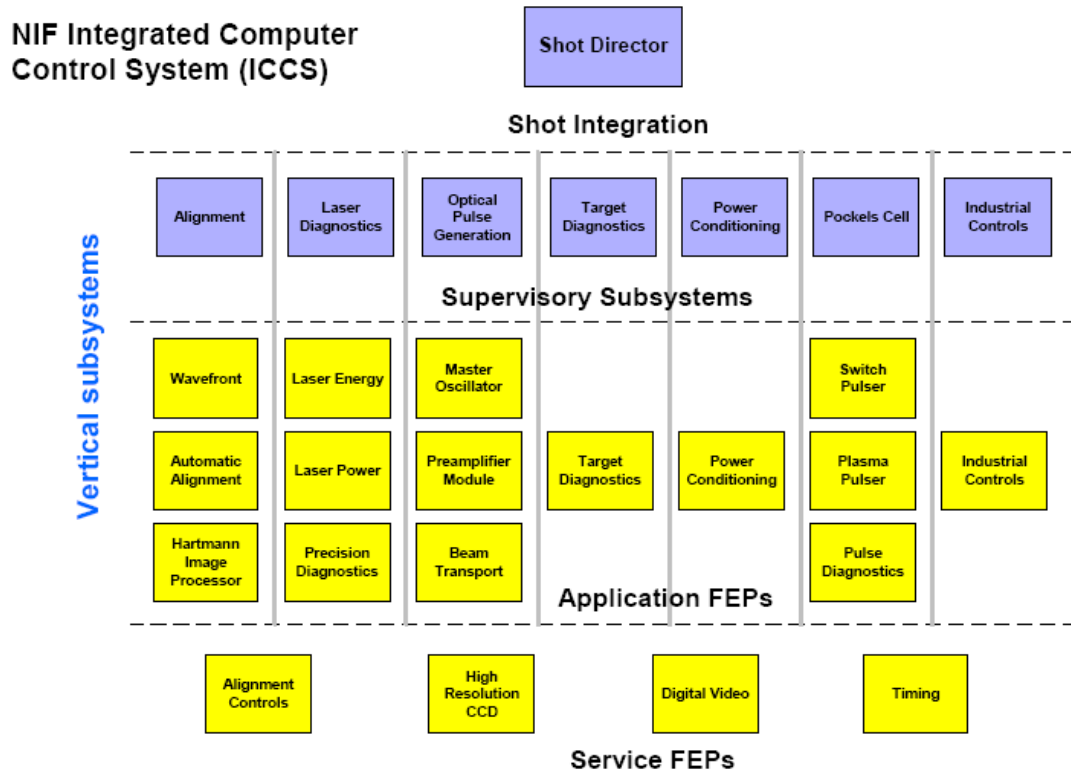


The NIF requires a control system of large scale that is enduring and flexible.

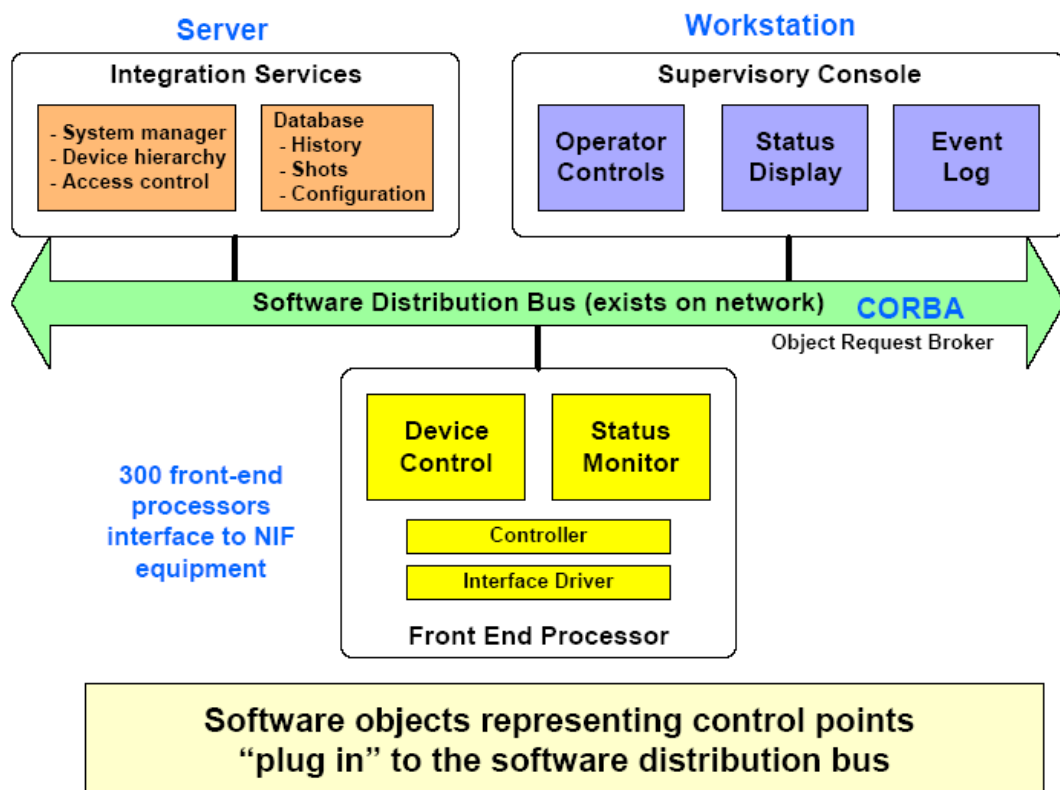


- 60,000 control points and 500 node network
- Automated 7 by 24 operation over 30 year lifetime
- Event driven control system conducts shot every 8 hours
- Designed for computer upgrades and software enhancements

Control functions are physically distributed, logically separated, and hierarchically layered.



Software applications are built the same way using a framework of distributed services.



Computers and programming languages used to build NIF controls



**Testbed Operator
Workstation**

Tool Category	Product
Computers	<ul style="list-style-type: none">- Sun Ultra Sparc- Power PC- Pentium- Allen-Bradley
Operating systems	<ul style="list-style-type: none">- Solaris UNIX- VxWorks real-time- WindowsNT
Programming languages	<ul style="list-style-type: none">- Ada 95 (applications)- C (drivers)- Java (user interfaces)- Rockwell (industrial)
Distribution - CORBA	<ul style="list-style-type: none">- ORBexpress for Ada 95- Visibroker for Java

Emulation techniques are employed to test software in advance of hardware availability

2. The Solar Whirligig Beetle

Environmental Monitoring
Tokyo, Japan

The Solar Whirligig Beetle



Project Introduction:

Rex Tokyo is a Japanese System Integrator with rich and diverse experience in the Industrial sector. Recently they developed the Solar Whirligig Beetle, which floats around the pond at Mitsugi Park in Itabashi-ku, Tokyo, and cleans the water. Advantech's ADAM-5000/485 Distributed DA&C System helped the customer find a cost-effective solution for their unique floating apparatus.

System Requirements:

The Whirligig Beetle has been developed with a solar-powered system consisting of solar cells and large-capacity batteries. Electric power generated by solar cells charges the batteries, which provide power to the Beetles control system and eight pumps located in the belly of the machine. Any product used in the Beetle needs to be compact, reliable, rugged and efficient, as well as easy to maintain and cost-effective.

System Description:

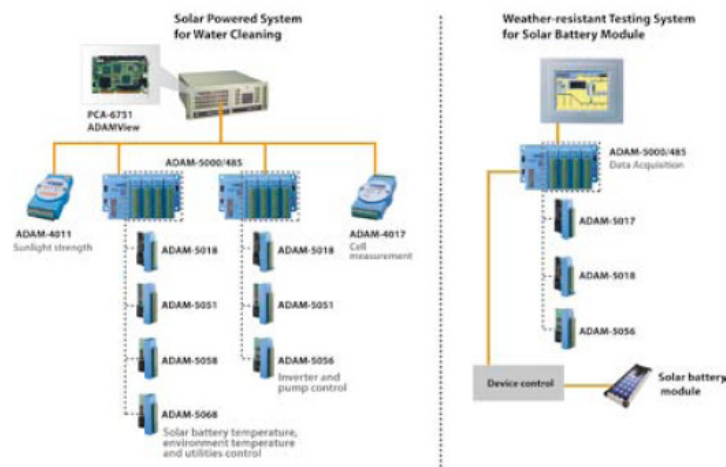
Solar Powered System for Water Cleaning

In this system, the ADAM products control inputs from sensors switches and outputs to relays. The ADAM products are consisted of the small ADAM-4000 and the ADAM-5000 series modules that can accommodate up to 4 modules per unit. ADAM-4011 will provide the data of sunlight strength, ADAM-4017 will provide the data of cell measurement, one set of ADAM-5000/485's will collect the solar battery temperature, environment temperature, and utility control, and the other set of ADAM-5000/485's will control the inverters and pumps. All communication is conducted via RS-485 multi-drop type network. With a solid state disk and Windows 98 OS installed, the PCA-6751 becomes a PC-based solar power generation system for water cleaning.

Weather-resistant Testing System for Solar Battery Module

This system contains PPC-102T with ADAMView software, and ADAM-5000/485 distributed data acquisition control modules.

System Diagram



Project Implementation:



ADAM-5000/485:
4-slot Distributed DA&C System
for RS-485 Networks



ADAM-5017:
8-ch Analog Input Module



ADAM-5018:
7-ch Thermocouple Input Module



ADAM-5051:
16-ch Digital Input Module



ADAM-5056:
16-ch Digital Output Module



ADAM-5068:
8-ch Relay Output Module



ADAM-4011:
Thermocouple Input Module



ADAM-4017:
8-ch Analog Input Modules
with Modbus



PPC-102T:
Multi-panel computer



PCA-6751:
ISA Tillamook Slot-PC SBC with Pentium 266
MHz CPU/VGA/LCD/LAN/CFC and PC/104

www.advantech.com/eA

Conclusion:

ADAM-5000/485 is a distributed data acquisition and control system with an RS-485 communication port. In a Solar Power System, it can connect up to 256 sets of ADAM products via command protocol. Compared to PLC system, it's a cost-effective and PC-based control system. Its distributed system will reduce maintenance cost. Additionally, the strongest feature of the PCA-6751 is in its power-saving capabilities; it consumes only 1.49A @ 5V during its suspend mode.

In both systems, ADAMView is installed as HMI software. It's an easy-to-use, flexible human machine interface software package with an intuitive, object-oriented GUI. ADAMView also offers a simple control strategy and display setup with a flexible industrial monitoring and control development environment, especially when used with ADAM I/O modules.

3. Water-level Monitoring System in the Brunei River

Environmental Monitoring
Brunei

Water-level Monitoring System in the Brunei River



Project Introduction:

Traditionally the people of Brunei live on the river, which can be both a convenience and a danger. During rainy seasons, it's important to monitor the levels of the river for the safety of the villagers. The government of Brunei wanted to build a remote monitoring system to help them keep track of these changes, and with Advantech's ADAM-4500 and ADAM-4011D modules, a simple and reliable and monitoring system was established.

System Requirements:

At least 30,000 people live in small villages on the Brunei River which has been the traditional way to live in this region for many generations. During the rainy season however, there are many flooding dangers for the people who live in these villages. To monitor the water level at all times, the government decided to set up a remote monitoring system along the Brunei River.

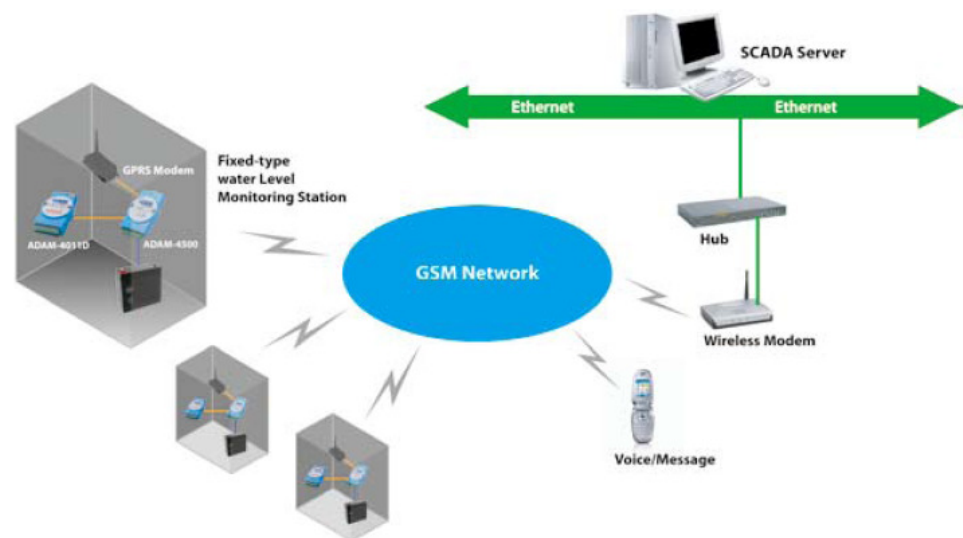
This potential life-saving system needed meet the following requirements:

- Wireless communication to cover the entire river basin
- A cost-effective way to supply power for the whole system
- A reliable and simple system to monitor and control the water level

System Description:

The monitoring system includes the ADAM-4500, ADAM-4011D, and GPRS modules. The ADAM-4011D is connected to the sensor to get the water level of the river. When the GPRS is triggered to power the ADAM-4500, it works as a controller to retrieve water-level data from the ADAM-4011D, and passes the data to a remote server through GPRS network within a certain period of time. Initially, it will retrieve the data every 10 minutes (when water is at a "safe" level). When the water level approaches a "dangerous" level, the data will be updated much quicker, up to every 2 minutes. Through the GSM network, the system can send warning messages to mobile phones for quick reaction.

System Diagram



Project Implementation:



ADAM-4500:
PC-based Communication Controller



ADAM-4011D:
Thermocouple Input Module



3rd party GPRS Modules

Conclusion:

To cover the entire Brunei River basin, wireless technology was the best solution for this project. With Advantech's ADAM-4500 and ADAM-4011D modules, a simple and reliable monitoring system was achieved. All power is supplied by a lead-acid battery. ADAM-4500 worked as a controller to retrieve and transfer the data to the data center via GPRS module, and then shuts down to save power. This feature also allowed onsite visits to be reduced, saving on manpower costs. Additionally, the systems wireless capability provides boundless communications without wiring issues.

3. Continuous Emission Monitoring System in a Thermal Power Plant

Environmental Monitoring
Beijing, China

Continuous Emission Monitoring System in a Thermal Power Plant



Project Introduction:

In China, a CEMS (Continuous Emissions Monitoring System) is required in power plants to monitor air pollution. The Department of Environmental Protection monitors and controls the air pollution through these units to charge corporations according to the data. With Advantech's UNO-2160, ADAM-5000/485, and ADAM-4000 modules, a new CEMS unit combines reliable operations with accurate data analysis.

System Requirements:

The Chinese Government is taking steps to control their air pollution. One of these steps has made it a requirement to setup a CEMS in every power plant to monitor air pollution emissions. This particular customer was using an outdated IPC system which was causing them problems with inaccurate data and unreliable operation.

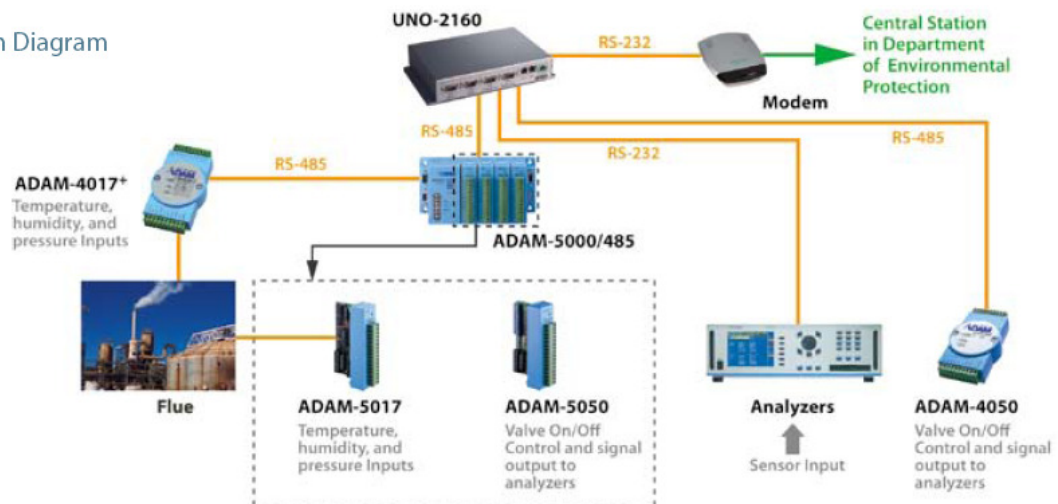
They needed to set up a new CEMS to reach the following goals:

- They wanted to have real-time monitoring of the emission levels, including the smoke, sulfur dioxide, and other chemicals from each stack. Additionally, all recorded data needed to be transferred to the Control Center at the Department of Environmental Protection.
- They wanted a reliable system to work as a data terminal to analyze, store, and distribute the data effectively.

System Description:

This CEMS adopted the ADAM-5000/485, ADAM-4000, ADAM-5000 and UNO-2160 modules. ADAM-5017 and ADAM-4017+ modules are connected to all the flues and work as data acquisition receivers; collecting temperature, humidity, and pressure data. 3rd party analyzers will collect and analyze TOC and CDO data via special sensors. In the event of any abnormal situation, the ADAM-5050 and ADAM-4050 will send an alarm and control the valve on/off. As a data microprocessor, UNO-2160 will store the acquired data, which will be transferred to Central Station Server at the Department of Environmental Protection via modem.

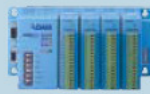
System Diagram



Project Implementation:



UNO-2160:
Celeron 400 MHz Universal Network
Controller with PC/104 Extension



ADAM-5000/485:
4-slot Distributed DA&C System for
RS-485 Network



ADAM-5017:
8-channel Analog Input Module



ADAM-5050:
16-channel Universal Digital I/O Module



ADAM-4017+:
8-channel Analog Input Modules with Modbus®



ADAM-4050:
16-channel Digital I/O Module

Conclusion:

A thermal power plant is a very harsh working environment. Fortunately, the UNO-2160 is designed as a rugged, fanless and compact unit for such applications. Its highly reliable operation reduces future maintenance costs, and additionally it accepts popular programming languages such as VC and VB so that engineers can easily work with it. ADAM-4000 modules also integrate Modbus and ASCII commands for direct communications. By combining the UNO-2160, ADAM-4000, and ADAM-5000 modules in this way, the new CEMS provides reliable, accurate, and efficient service for our customer.

4. Data Acquisition and Monitoring System in a Petrochemical Facility

Facility Management
Beijing, China

Data Acquisition and Monitoring System in a Petrochemical Facility



Project Introduction:

In petrochemical manufacturing it's very important to monitor the temperature and pressure of the air separation tower, compressor, heat exchange, rectification tower, and the vapor pipeline for the control room. In this application, our customer wanted to upgrade their petrochemical facility with a more reliable and efficient monitoring system. Combining Advantech's IPC-610 and ADAM-5000/485 modules became the right solution to solve all of their critical requirements.

System Requirements:

Our customer had been using an out-of-date on-site monitoring system for over 6 years, which had the following issues:

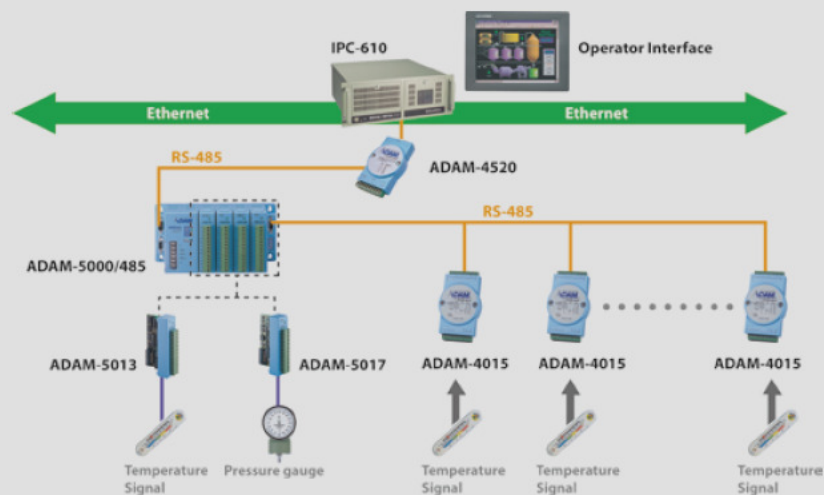
- The system was inefficient, requiring a large number of employees to check the on-site data manually.
- The system was becoming unstable, and increasingly unsafe for employees to work with.
- The system was becoming unreliable, and experiencing increasing system failures.
- The facility was no longer satisfying production requirements, and maintenance costs were rising.
- The system had minimal communication ability, and required one with a synchronized database via the internet.

To prevent any problems in operation, it's important to have a reliable and real-time monitoring system for the air separation tower. Our customer wanted to develop an advanced and reliable monitoring system with the ability to automatically respond in the event of any abnormal situation, and one that was easily upgradeable in the future.

System Description:

The monitoring system includes Advantech's ADAM-5000/485, IPC-610 and the KingView software. It monitors and records temperature and pressure in the air separation tower, based on RS-485 distributed ports. ADAM-5000/485 contains two ADAM-5017 8-channel Analog Input Modules to detect pressure signals, and two ADAM-5013 3-channel RTD Input Modules to detect temperatures. ADAM-4015 6-channel RTD Modules collect temperature signals below -200° C from field equipment. ADAM-5000/485 collects all data from I/O modules and converts to IPC-610 data server via the RS-485 communication port. Operators can monitor the data through a simple graphic display in the KingView software.

System Diagram



Project Implementation:



ADAM-5000/485 :
4-slot Distributed DA&C System
for RS-485 Networks



ADAM-5017:
8-channel Analog Input Module



ADAM-5013:
3-channel RTD Input Module



ADAM-4015:
6-channel RTD Module with Modbus



IPC-610:
4U 14-slot Rackmount Chassis
with ATX Motherboard Option



KingView software

Conclusion:

The purpose of air separation equipment is to separate nitrogen and oxygen for internal use. If it fails, an accident will occur; therefore, the monitoring system becomes very important to protect operations. Compared to a PLC system, using ADAM-5000/485 with ADAM data acquisition modules is very cost-effective. Operators can read field data in the central control room via this monitoring system without manually checking the data themselves. This reduces the time to review data, labor cost, and lowers the risk of danger. Additionally, the working efficiency is increased relatively. Furthermore, all handwritten data records are replaced with digital data storage; now all data is stored in a data server, so that operators can retrieve it anytime from the new system.

5. Integrated Solutions for Power Management Systems

Facility Management
Milan, Italy

Integrated Solutions for Power Management Systems



Project Introduction:

Since 2004, the energy free-market has been open to all non-domestic suppliers. This offers great opportunities for Embedded Monitoring and Control SCADA Systems based on Windows XP Embedded platforms. In light of this, HP Italy decided to setup a reliable power management system to control and monitor energy consumption, targeted at saving them millions of dollars annually. Integrated with Advantech's control and I/O modules, IOTA has set up a total solution in Milan's HP Italy.

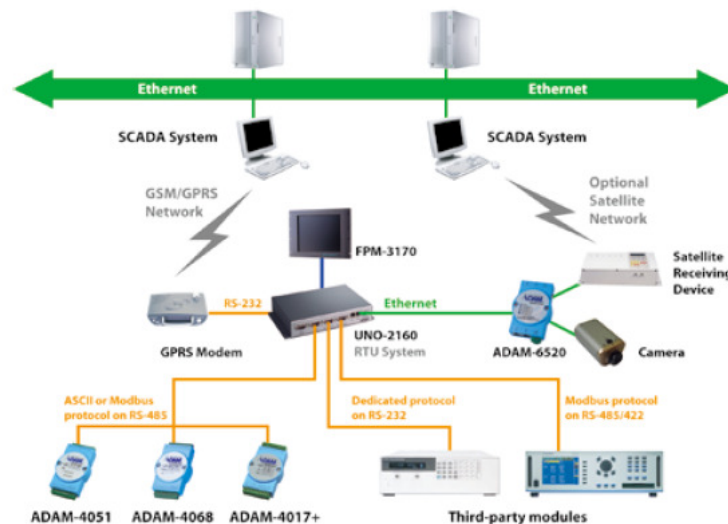
System Requirements:

Large companies, such as Telecommunications Providers, Industrial Foundries, and companies with high electrical demands, may now get economical advantages from monitoring, planning and provisioning their electric consumption, and using information for real-time trading in the energy free-market. It is very important to have specialty know-how in three different applied fields to develop this integrated project: Energy Market Trading, Expert Systems for Planning and Provisioning, and Process Control and Identification. For Process Control and Identification, IOTA has chosen an Embedded SCADA solution, with Advantech control and I/O modules, and 3rd party equipment for Power Monitoring and Building/Factory Automation field level interfaces.








System Description:

Installed with IOTA's C.I.PRO. SCADA software, the UNO-2160 becomes a RTU platform to control and monitor field equipment data. UNO-2160 further solidifies itself as an excellent remote manager due to the ease in which it connects to GSM/GPRS modems and other optional satellite networks. Additionally, Advantech's ADAM-4000 series, ADAM-6000 series, and FPM series are the best solutions for I/O, COM and HMI interfaces. Because UNO is an open platform, there are no issues when connecting to 3rd party products. 3rd party modules are used for power analysis via Modbus through RS-232 or RS-485. Operators can remotely control and monitor the entire system via HP Tablet PC's installed with C.I.PRO. SCADA software.

System Diagram



Project Implementation:

 UNO-2160: Celeron 400, 256MB SDRAM, 2xLAN, 2xRS232, 2xRS485, 2xUSB, 1xPCMCIA	 FPM-3170: Industrial 17" flat panel monitor with resistive touchscreen	 ADAM-6520: 5-port Industrial 10/100M Ethernet Switch	 ADAM-4051: 16-channel Isolated Digital Input Module with Modbus
 ADAM-4068: 8-channel Relay Output Module with Modbus	 ADAM-4017+: 8-channel Analog Input Module with Modbus	 C.I.PRO. RTU System: embedded SCADA software	

Conclusion:

Through the use of Advantech's products, it became possible to develop different solutions with the least encumbrance and lowest power consumption, while fulfilling diverse interface requirements. UNO's open architecture made it easy to integrate additional 3rd party products, and the UNO series is excellent as a remote monitoring system because it easily connects with GSM/GPRS modems. Moreover, this solution allows for easy implementation and integration with other supervisory and control facilities.

The benefits obtained from the Power Management Solution are immediately visible through excellent economic savings

6. Warehouse Crane Control System in the Metal Industry

Facility Management
Kaohsiung, Taiwan

Warehouse Crane Control System in the Metal Industry



Project Introduction:

A customer was using manual crane operation to move the steel inventory in their warehouse, which required additional employees on the floor to communicate with the crane operator. This was causing a lot of problems, including; shipment delays, inefficiency, and increased safety risks. By incorporating Advantech's UNO-2170, FPM-2150, and ADAM-4052 modules, the system was upgraded to a semi-automated system with reliable operation, improved efficiency, and reduced risks to employees.

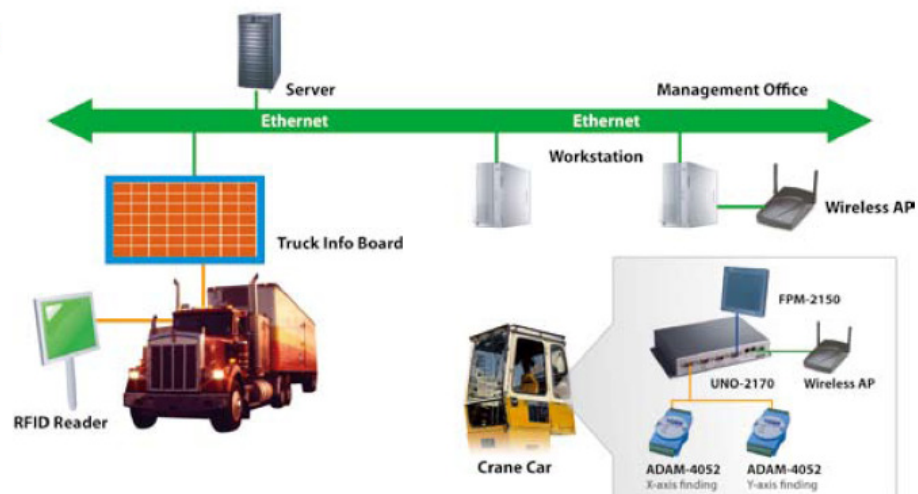
System Requirements:

The customer was using an out-of-date method for inventory control in their warehouse. First, the staff would get the shipment notice from sales, and then inform the crane operator which products to get from the warehouse via wireless intercom. It usually took a lot of time for this series of communications, and many employees were needed on the warehouse floor to help direct the crane operator, all of whom were at safety risk. The customer wanted to improve the efficiency of the crane control system and increase the workers' safety.

System Description:

When trucks arrive at the warehouse, all information is updated through the RFID reader, which can also notify the management office in real-time. Then management office can then get the materials request and send it to the UNO unit in the crane car. From the FPM-2150 monitor, the operator will find the exact location of the materials through the two ADAM-4052 modules; one for the X-axis and the other for the Y-axis. Operators can easily execute the pick & place tasks with this efficient, fast-delivery system.

System Diagram



Project Implementation:



UNO-2170:
Celeron M 1GHz Universal Network Controller
with PC/104 Extension



FPM-2150:
Industrial 15" Flat Panel Monitor
with Direct-VGA Port



ADAM-4052:
8-channel Isolated Digital Input Module

Conclusion:

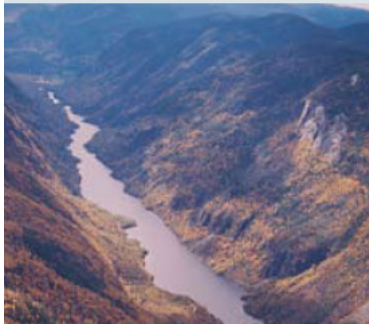
Crane operation is a rugged and high-vibration machinery process, which makes the UNO-2170 the perfect anti-vibration control mechanism to be installed in the crane. Its compact size is the perfect fit for limited space and its fanless design provides reliable operation. Additionally, FPM-2150 is a lightweight monitor and can easily be installed in the crane. Combining the FPM-2150 and UNO-2170, provided the perfect solution to upgrade the crane control system. Furthermore, because the monitor and the computing system are separate, future maintenance on the units can be completed much easier.

It usually took about 20 minutes to get the materials from the warehouse to truck after the truck arrives at the warehouse. After installing this new system, the process is shortened to 10 minutes. Also, it used to require a lot of employees to be on the warehouse floor to help manage the material movement. The new semi-automated system reduces labor costs as well reducing risks to the on-site employees.

7. Hydropower Station Management in the Gongbo Gorge

Facility Management
Qinghai, China

Hydropower Station Management in the Gongbo Gorge



Project Introduction:

The Gongbo Gorge Hydropower Station is located on the upper reaches of the Yellow River in the Qinghai province of China. This facility is an integral part in China's project to speed up the development of their Western provinces. Equipped with five sets of hydraulic power generators, this facility requires a reliable management system to monitor temperature, humidity, and security of the control room, main station, and the substation in the power plant.

With a combination of Advantech's ADAM-5510KW, AWS-8248, and KW ProConOS SoftLogic software, all of the control systems in the facility are integrated for easy and efficient monitoring.

System Requirements:

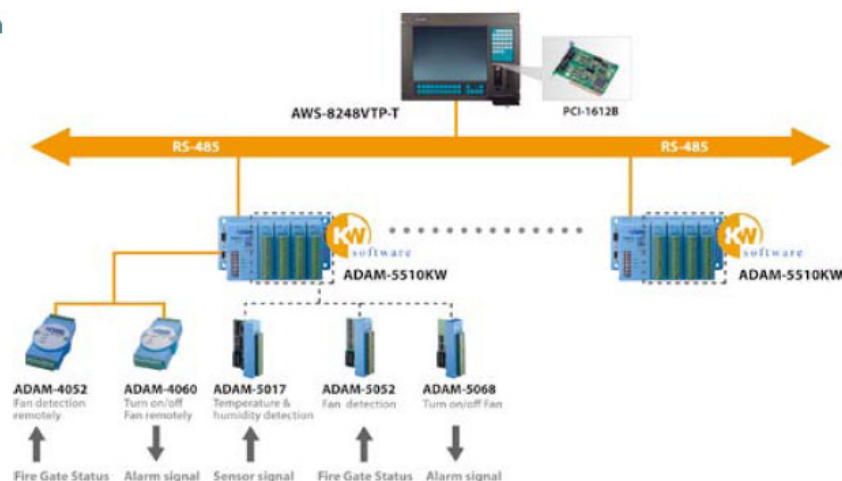
The implementation of the West Development project is a momentous undertaking by China's Central Party Committee, and the Gongbo Gorge Hydropower Station is an important project in their overall strategy. Due to the importance of this facility, there was a great need to establish a highly reliable management system to monitor the facility's environment, and be able to react immediately in an emergency situation. For these reasons the following elements had to be in place:

- A central monitoring system for temperature and humidity to distribute to the main station, substations, and the remotely located control rooms. The system needs to be standalone; with self-diagnostic capabilities and expandable communications.
- A reliable system to control the exhaust, ventilator, and other fire alarm devices remotely or on-site. This system needs to be able to be switched to manual control automatically in case of an emergency.
- In the event of any unusual situation, such as high temperatures, an overload in ventilator, or a broken circuit, a malfunction report and an alarm message must be able to be sent out immediately.
- Central and real-time displays for operation of the air conditioner, ventilator, environment temperature, and status of the fire gate.
- The system should be easy to install, with anti-noise features, low-cost, and open-architecture. This will be helpful for the engineers to maintain, upgrade, and modify the system.

System Description:

ADAM-5510KW is a standalone controller which can collect and analyze data from field devices via an RS-485. All actions can be determined immediately and executed through digital output modules. Additionally, ADAM-4052 and ADAM-4060 are connected to ADAM-5510KW for remote monitoring, and controlling the fan. All data will be transferred to central host - AWS-8248VTP-T. It is installed with PCI-1612B for automatic data flow in RS-485 serial port. Also, the ADAM-5510KW is built-in with KW ProConOS® (a real-time PLC OS) and the MULTIPROG® programming tool, which is a powerful and user-friendly graphic tool providing 5 standardized programming languages for PLC users, and also provides simulations to shorten development time.

System Diagram



Project Implementation:



ADAM-5510KW:
4-slot PC-based SoftLogic Controller



ADAM-5017:
8-channel Analog Input Module



ADAM-5050:
18-channel Universal Digital I/O Module



ADAM-5060:
6-channel Relay Output Module



AWS-8248VTP-T:
Cost-effective Modular 15" TFT LCD Workstation with 14 Expansion Slots



PCI-1612B:
4-port RS-232/422/485 PCI Communication Card, w/ Surge Protection

Conclusion:

This reliable control and monitoring system provides information of environment temperature, humidity, fan operation, and fire equipment from the distribution main station, substations, and control rooms in an extensive and complex facility. ADAM-5510KW can remotely control the distributed I/O systems and edit the data at anytime. Even during a power failure, settings will not be lost. Additionally, it is easy to operate with central management, alarm notification, and data logging features. Built-in with KW ProConOS® SoftLogic, the ADAM-5510KW provides powerful functions to shorten development and maintenance time with user-friendly graphic designs. The system is also modular, allowing for easy future expansion.

8. Control and Monitoring of a Regional Water Supply System

Facility Management
Macedonia



Control and Monitoring of a Regional Water Supply System

Project Introduction:

"Studencica" is a Public Enterprise, distributing quality drinking water to cities and villages in the central & western regions of Macedonia, having a total length of more than 130km of main pipeline.

The goal of the project is to centralize the measurement of water consumption and remotely control the water flow level in each node (branch), as well as to collect all the information about the status and alarms from the actuators.

System Requirements:

In a regional water supply system, many different users (like municipalities, villages, industrial enterprises, and power plants) are connected directly to the same system, and they all expect good quality water everyday. A Centralized Control and Monitoring System has to be established in order to provide the same level of water to every user at all times, especially during dry periods, which can last for many years.

By the implementing a Centralized Control and Monitoring System, the customer hoped to achieve:

- Precise and centralized measurement of the water flow in all main branches and supply points at all times, with the ability to measure water usage during specific fiscal periods.
- Depending on the available quantity of inlet water from the wheels, and based on the predefined government approved water distribution laws, the central computer remotely regulates the water flow at each node, providing an exact quantity of water to every user, so that no one branch gets a higher privilege.

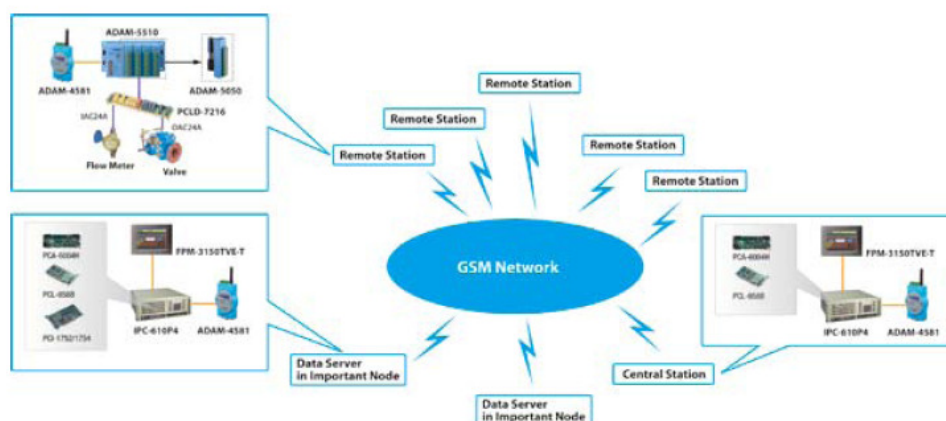
The overall enhancements of this system should also include:

- Dramatic reduction of staff required to operate the system.
- Reduction of the operation and maintenance costs.
- Improvement of the security and safety of the equipment, pipeline and water.

System Description:

A Centralized Measuring, Supervisory & Control System, this system is intended to operate automatically, with little manpower present. There are 24 main nodes in the water supply system, each with one or more branches. The nodes with more than two branches or those that provide data to the local Municipality are treated as important nodes. There is at least one precise water flow measuring instrument and one motor-operated valve in each remote station. With ADAM-5050 I/O modules, ADAM-5510 works as a local controller to read data from Flow Meter via IAC24A modules and controls the valve through OAC24A modules. It will create data log in its battery back-up memory for the measured values, events, valve status and alarms, and transfer all data to a data server via ADAM-4581. It will also transfer requested data from the central computer via ADAM-4581. With ADAM-4581 modules, local controllers or industrial computers in the whole system work inside of the GSM network. On the other hand, the Central Computer can send a new **Water Sharing Principle** to the local controllers directly or automatically for any changes.

System Diagram



Project Implementation:

 ADAM-5510: PC-based Programmable Controller	 ADAM-4581: 1-port GSM to RS-232/422/485 Data Gateway	 IPC-610P4: Industrial Computer Chassis	 PCLD-7216: 16-ch SSR I/O Module Carrier Board IAC24A: AC Input Module (180 ~ 280 VAC) OAC24A: AC Output Module (24-280 VAC)	
 PCA-6004H: VIA C3 800 MHz (onboard CPU) Card with HISA/VGA/LAN/LCD	 PCL-858B: 8-port High-speed RS-232 Communication Card	 PCI-1752/54: 64-ch Isolated Digital/Input Output Card	 FPM-3150TVE-T: Industrial Flat Panel Monitor with 15" LCD in Direct-VGA Port with Touch Screen	 Special developed control algorithms and software provided by solution partner

Conclusion:

A water supply system is a very complex and complicated model, consisting of a long main pipeline with many branches, valves, and hybrid mechanical devices. Though the physical elements are a long-term constant, it is difficult to set up a proper control mechanism for the entire system. Only PC-based controllers provide fast enough computing performance, adequate memory size, good communication interface, and simple programming languages to successfully reach the goals of this project. It is important to note that almost all controlled nodes are outside of urban areas where no wired telephone lines exist. That is why it was decided to go with wireless communication, using ADAM-4581 as the main communication device in a WAP/GSM network. Because there is no need for fast and frequent data exchange in this project, the communication charges in the system are very low.

A high-performance and reliable water supply control system was achieved, which can properly adjust water levels at all branches off of the main pipeline, and provide adequate water sharing between all users. Furthermore, its precise measurement and communication abilities decrease financial, operational, and maintenance costs.

9. Automated Passenger Clearance System

Facility Management
Hong Kong

Automated Passenger Clearance System



Project Introduction:

To meet the challenges of ever-increasing passenger traffic through customs, more and more countries are choosing to employ the Automated Passenger Clearance System (APCS). In Hong Kong, the government decided to upgrade their existing system as well, dubbing their APCS the "E-Channel". With Advantech's UNO-2052 Universal Network Controller, all devices are integrated in an open architecture.

System Requirements:

More than 400,000 people pass through customs in Hong Kong everyday. At the Luohu checkpoint, each traveler is given about 1min to be identified. Since Hong Kong is one of the most popular tourist and business destinations in Asia, not to mention a major trading and transportation hub, Customs Officials must constantly review procedures and explore ways to allow passenger clearance to run more efficiently. Their latest effort is an APCS project called the "E-Channel", which incorporates many new technologies such as; Biometrics, Smart Cards, Wireless Functionality, and Embedded PC's. They hope this system can reach an 8-12 sec per person processing time. Based on their requests, the system required the following specific parameters:

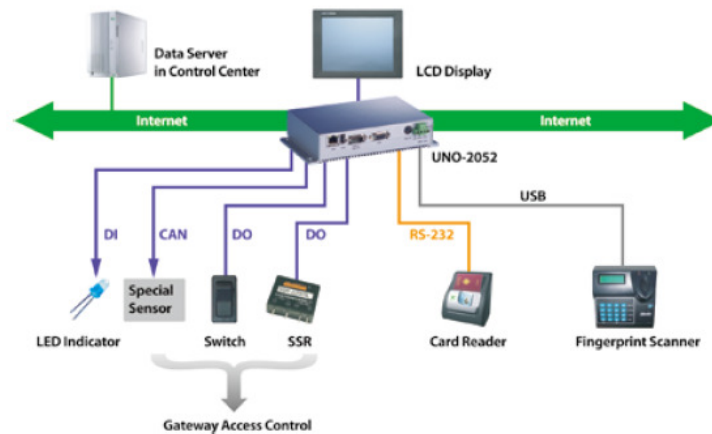
- Compact size
- USB port support for the fingerprint scanner
- CAN port support for special sensors
- COM port support for communication with the card readers
- LAN support for an Internet connection
- Support for DI/O ports to control LEDs, and switch on/off
- Economic price
- Stability and Reliability

System Description:

The UNO-2052 works as a central controller to integrate multiple devices. It is connected to a fingerprint scanner via USB, Smart Card readers through an RS-232, gateway access control, an LED Indicator via CAN and DI/Os, and a Central Data Server through LAN.

The E-Channel's processing system is simple; first people walk up to the card reader unit, and insert their Smart Identity Cards. The system will then connect to the Central Data Server to get identity approval through the Internet. While getting approval, it will notify the gate doors to open, and people can enter the E-Channel. After entering, people place their thumbs flat on the centre of scanner for fingerprint analysis. After verification, the gate doors will open and they can leave. Only one person is allowed to enter the E-Channel at a time. While one person is going through the fingerprint verification, the next person in queue may insert their Smart Identity Card into the reader. In the event of an error or accident, the system can send out a warning message to customs personnel through wireless communication.

System Diagram



Project Implementation:



UNO-2052:
GX1-300 UNO with 2 x CAN, LAN, USB,
RS-232, 8 x Isolated DI/O, 2 x AI

Conclusion:

UNO-2052 is the perfect controller for this complex system. Its compact size can fit into the limited space, and fanless design provides high reliability and stability for continuous operation. Compared to other PLCs, the UNO-2052 provides open architecture for easy integration with other devices and popular software such as Windows CE. Furthermore, it offers rich communication interfaces such as CAN, DI/O, serial port, and USB ports to easily connect to other devices. Advantech works closely with this customer to provide local technical support. Now, the process time through Hong Kong customs has been shortened to 8-12 seconds per person, providing our customer and travelers alike with more efficient and speedy processing.

10. Temperature Monitoring System in the Metal Industry

Facility Management
Kaohsiung, Taiwan

Temperature Monitoring System in the Metal Industry



Project Introduction:

The China Steel Corporation wanted to develop a new monitoring system for their blast furnace. It's important to monitor the temperatures in a blast furnace because at high temperatures molten metal can spurt out of the furnace, destroying nearby equipment and putting employees in great danger. With Advantech's ADAM-5000/TCP and I/O modules, operators can remotely monitor the inside temperature of the blast furnace from a protected environment within the facility.

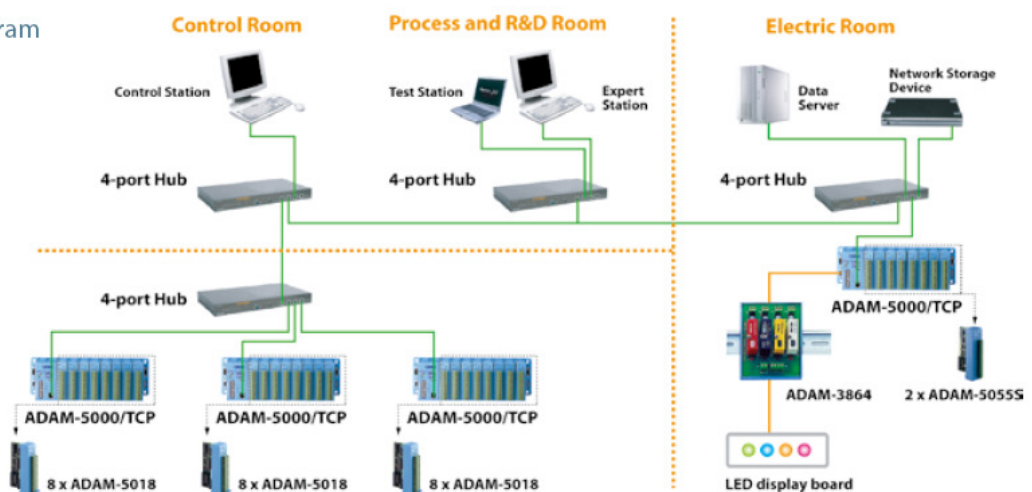
System Requirements:

One of our customers in the Metal Industry desired to build a remote monitoring system for their blast furnace. The security of blast furnaces is always an important issue in steel plants, due to extreme instability and danger that high temperatures can cause. Additionally, the customer wanted to use VB.net to develop system, an Ethernet-based development tool, so that operators can remotely retrieve recorded data from the internet.

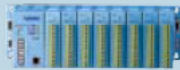
System Description:

The whole system is divided into 4 areas: the Control room, the Process & R&D Room, the Electric Room, and the Field facility. In the Field facility, the temperature data of the blast furnace is collected through an ADAM-5000/TCP with ADAM-5018 I/O modules. All data is transferred to a hub, so that everyone around the factory can remotely retrieve data through the Ethernet. In the Control Room, staff can monitor the data in the same way, and execute necessary actions when accidents occur. In the Process & R&D Room engineers can continuously develop new systems, and then track the stability of what they are working on. In the Electric room, employees collect and store all data in the data server.

System Diagram



Project Implementation:



ADAM-5000/TCP:
Distributed DA&C System Based on Ethernet



ADAM-5018:
7-ch Thermocouple Input Module



ADAM-5055S:
16-ch Isolated Digital I/O Module



ADAM-3864:
4-ch Solid State Digital I/O Module Carrier Backplane

Conclusion:

Advantech's ADAM-5000/TCP is a powerful data acquisition and control system. It can remotely acquire data and transfer it back to the staff. Furthermore, Advantech's R&D team fully supported the customer by developing a VB.net driver in the ADAM-5000 series, which satisfied one of the customer's special requirements. Benefits from the new system included; cost saving, quality improvement, and raised productivity. This remote monitoring system also reduces the rate of accidents and extends the life cycle of on-site equipment, by saving it from exposure to high temperatures and molten steel.