Intelligent Agricultural Solutions

Farm management innovation with technology that realizes all the possibilities of intelligent monitoring and control

When Internet of Things (IoT) technology is successfully applied to farm management, smart agriculture is an inevitable trend, accurately monitoring information from agriculture environmental control to the crop growth process to achieve high yield good quality harvests.

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WebAccess+
Alliance

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Agricultural Intelligence

Innovative farm management technology, realizing the possibilities of intelligent monitoring and control

In recent years, with the mature development of Internet of Things (IoT) technology, the introduction of information and communication technology and automation control technology in farm management has become a recent trend.

In the field of agricultural intelligence, introducing technology elements into farm management, such as monitoring and tracking of the whole process from the production of crops, processing, transportation, to sales and other procedures, can effectively overcome the impact of complex and volatile climate, the geographical limitation, natural disasters, pests and diseases, and other factors, improve crop yields successfully, and manage crop growing process and production quality. The scenarios can be divided into two major applications: intelligent greenhouse and plant factory.
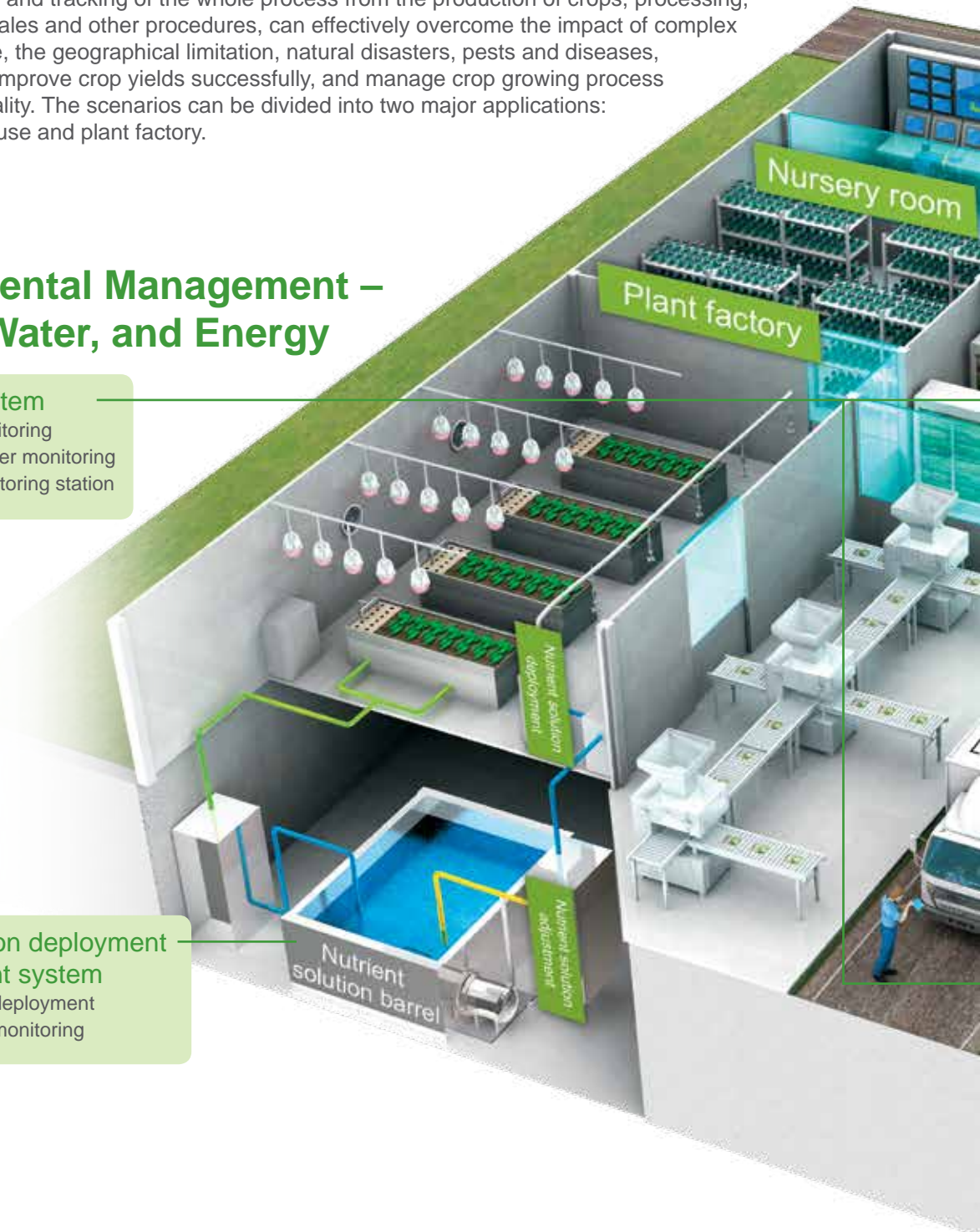
Environmental Management – Climate, Water, and Energy

Monitoring system
- Microclimate monitoring
- Soil, medium, water monitoring
- Atmospheric monitoring station

Nutrient solution deployment and adjustment system
- Nutrient solution deployment
- Nutrient solution monitoring

Nursery room

Plant factory

Nutrient solution deployment

Nutrient solution adjustment

Nutrient solution barrel

Cloud Management

Cloud platform of intelligent agriculture
• Real-time remote monitoring and management
• Historical data analysis and charts
• Experience replication and remote expert consultation
• Intelligent production record

Control Room

Inspection center

Storage freezer

Classification and packaging area
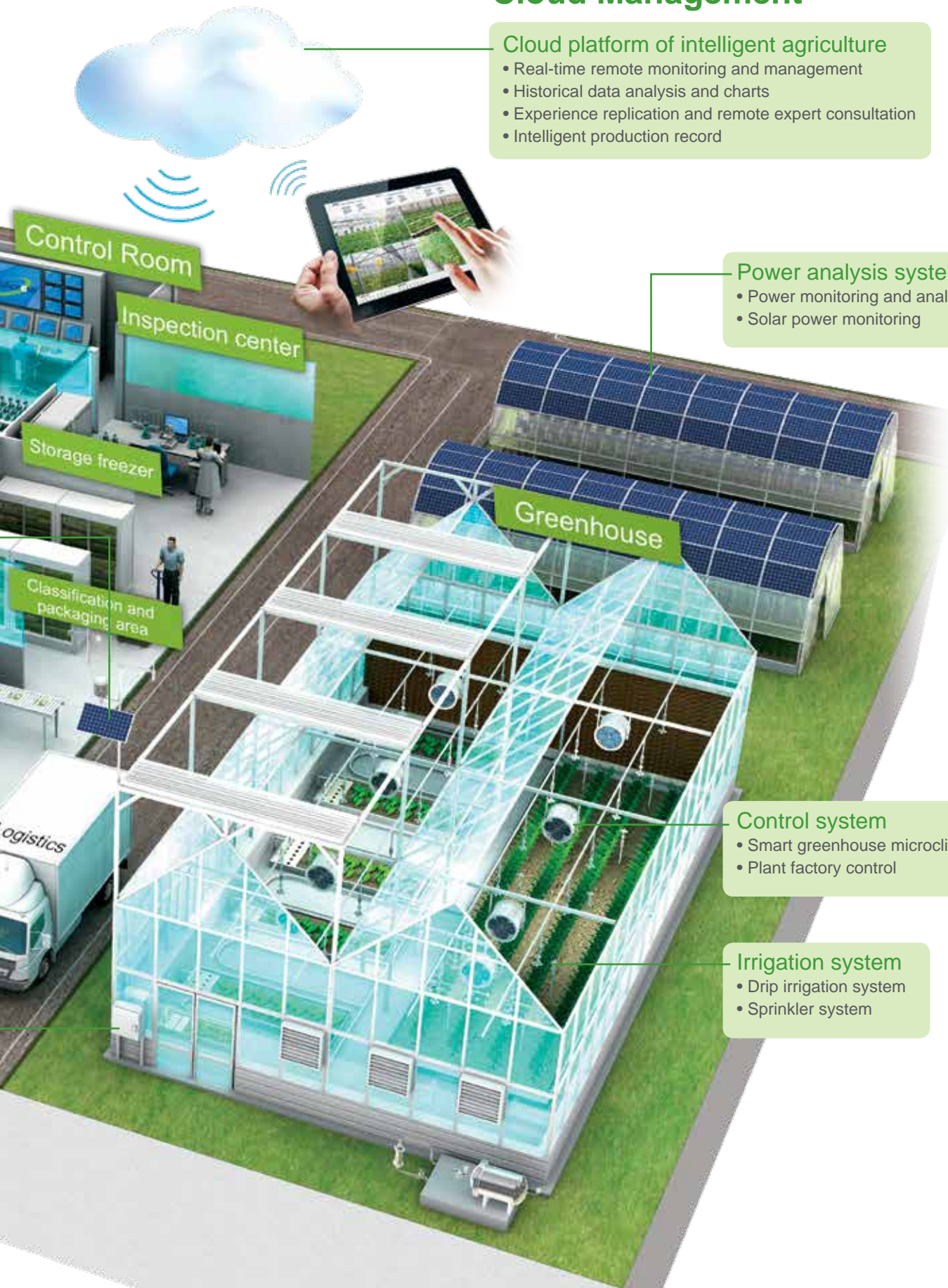
Logistics

Greenhouse

Power analysis system
• Power monitoring and analysis
• Solar power monitoring

Control system
• Smart greenhouse microclimate control
• Plant factory control

Irrigation system
• Drip irrigation system
• Sprinkler system

Environmental Management
– Climate, Water, and Energy

Monitoring Systems ◾

Soil, medium, and water monitoring

• Monitor soil/media for pH, conductivity, temperature, humidity etc. for the best growing conditions

• Monitor water quality including pH, conductivity, temperature, dissolved oxygen etc.

• Provide optimal settings and send warnings via SMS/e-mail when incidences occur so that optimum conditions can be maintained

• View historically stored data and produce graphs to view trends

Microclimate monitoring

• Use sensors to monitor environmental aspects such as temperature, relative humidity, sunlight, carbon dioxide, wind speed and produces images of crop growth

• Provide optimal settings and send warnings via SMS/e-mail when incidences occur so that optimum conditions can be maintained

• View historically stored data and produce graphs to view trends

Atmospheric monitoring station

• Use sensors to monitor atmospheric conditions such as: temperature, relative humidity, wind speed, wind direction, rain, snow and sunlight

• Improve the efficiency of greenhouses by analyzing the difference between internal and external temperatures

• Use historical analysis to predict short-term changes in the atmosphere to enhance the stability of the indoor climate

Control Systems

Intelligent greenhouse microclimate control

- Use sensors to monitor indoor and outdoor atmospheric data and automatically adjust the temperature, humidity, shade nets, insulation curtains, fans, skylights etc.

- Configure devices separately for multiple crops

- Adaptive greenhouse management for a wide range of controls

- Reduce labor costs and errors and diseases for greater quality and stability

Plant factory control

- Use sensors to monitor temperatures, relative humidity, carbon dioxide concentration using air conditioning systems, circulating fans, artificial light sources etc.

- Use indoor air conditioning to save 70% of water consumption

- Adjust artificial light to shorten production time and increase capacity

Power Analysis Systems

Power monitoring and analysis
- Use sensors to see and record the greenhouses' electrical status

- Use recorded power data to calculate and analyze the cost of each device

Solar power monitoring
- Automatically use shade nets to reduce the intensity of the sunlight and reduce power usage

- Analyze independent power sources and adjust their use depending on the requirements

- Calculate the total cost of electricity generation and its use

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Environmental Management
– Climate, Water and Energy

Irrigation Systems ▪

Drip irrigation system

• Use drip irrigation sensors to monitor soil moisture conductivity, pH levels etc.

• Use soil moisture sensors to control conditions and quality

• Permeability ensures that water from the pipeline is used

• Drip devices, plugged into a PE pipe, automatically regulate the flow

• With no water between crops, weeds can't grow

• Drip irrigation systems are: labor, water, energy & yield improving

• Irrigating water and fertilizer directly on the soil, crop roots maintain the optimal conditions to increase production

Sprinkler system

• Soil moisture sensors control the sprinkler system

• The analog sensors' signals are converted from analog to digital for saving

• Convert signals to the same value as the soil moisture tension meter to become linear

• Monitor soil moisture conductivity, pH and other sprinkler data for the best conditions

• Provide strategies for control conditions, schedule and quantity

• Automatic correction of salinity during freezing temperatures

• Low construction cost, and rapid foliar absorption, increases greenhouse humidity and reduces temperature

• A low-cost and labor-saving irrigation management system

Nutrient solution deployment and adjustment Systems

Nutrient solution deployment

- Effectively monitor and control the deployment of the nutrient solution, and manage routine work, including water quality used to modulate the conditions

- Adjust the proportion and concentration of the nutrient solution, and then send the information to the irrigation

- Crops grow at different rates, automatically adjust the nutrient solution for better growth

Nutrient solution adjustment

- Real-time monitoring of various conditions, means that changes can be made as soon as an issue is seen

- Get the benefits of circulating nutrients and use a clean room to increase fertilization & yield, and prevent diseases

- Automatically adjust the nutrient solution schedule according to the crops' requirements

Cloud Management


Cloud platform of smart agriculture

Real-time remote monitoring and management

• Remotely check real-time information and control next line through computers, tablets, mobile phones, and other devices

• Manage distributed systems, nutrients, temperatures etc across multiple greenhouses

• Provide different workers with different levels of authority

• Get real-time information via SMS and e-mail alerts

Analysis of historical data and charts

• Integrated charts for analysis & problem identification for enhanced crop cultivation

• Sensor data's automatically uploaded to the cloud for future analysis and queries

• Provides private cloud and public cloud
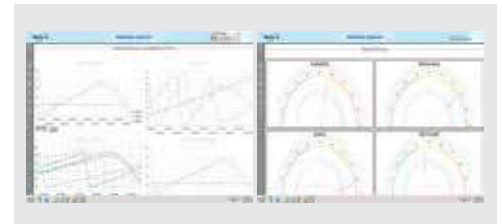
Remote expert consultation

• Share greenhouse experiences and data with other greenhouses to get advice

• Improve farmer education by providing the latest green innovations

• Experts can provide objective & accurate diagnosis

Intelligent production record

• Record details of the production system eg. location, farmer, soil quality, growth, harvesting time, fertilizer use etc.

• Automated production of records for an exact record of quality control, pesticide residue etc.

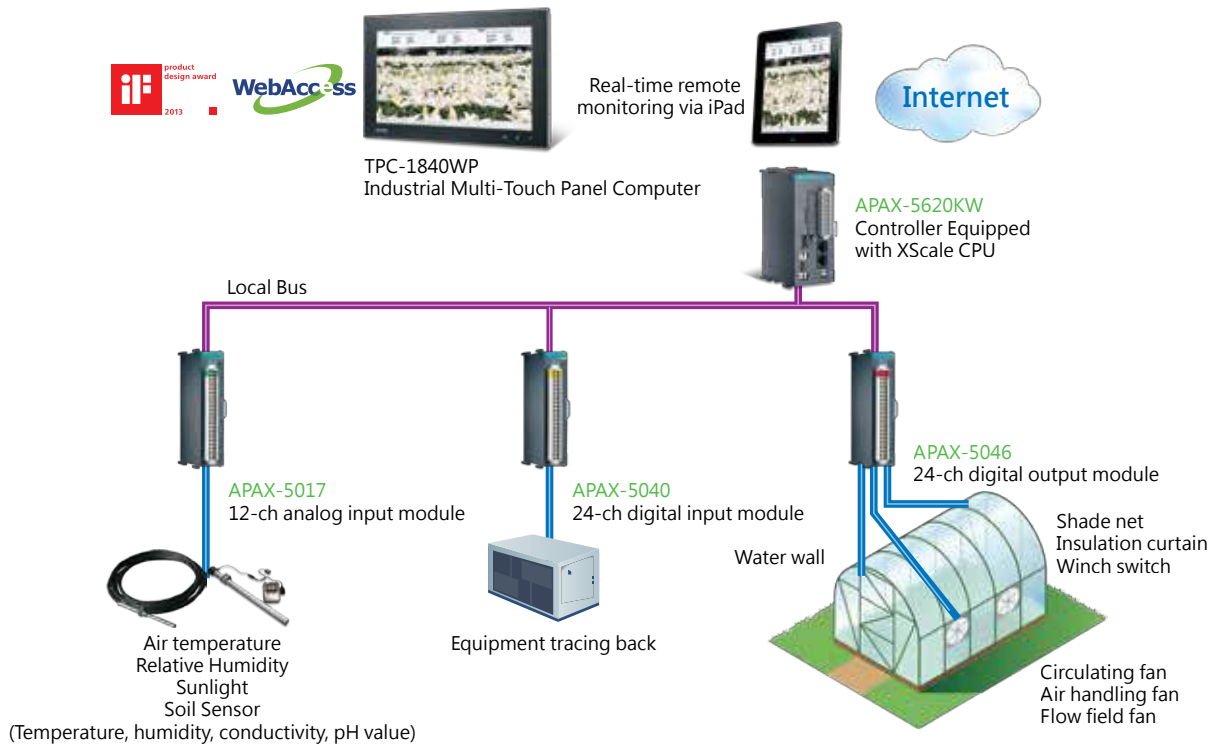# Remote Monitoring System for Mountain Lily Planting

Champion flowers growing in smart greenhouses

Environment and climate have always been important factors when planting crops. Good environment, water, air, and proper environmental management are the keys to the success of crop cultivation. Thus, members of the Alishan flower production and marketing team adopted greenhouse cultivation, and a smart remote monitoring system, to cultivate a variety of championship perfume lilies.

DeNeng Scientific Research assisted Alishan farmers in building a greenhouse management program. Advantech's APAX-5620KW programmable automation controller and several APAX I/O modules were used to connect agricultural sensors and greenhouse equipment in the greenhouse for gathering comprehensive data such as air, temperature, relative humidity, sunlight, soil pH, conductivity, and so on. It can also control peripheral devices to ensure optimal planting conditions. To solve the problem of traffic in remote mountains, cloud architecture was used to control the conditions in the greenhouse, and query raw data and analysis results in the cloud database via phone or remote computer. This smart remote monitoring solution of the greenhouse can also create an adaptive greenhouse microclimate, increasing the pest-resistance of the lily.

System Diagram

Real-time remote monitoring via iPad

Internet

TPC-1840WP
Industrial Multi-Touch Panel Computer

APAX-5620KW
Controller Equipped
with XScale CPU

Local Bus

APAX-5017
12-ch analog input module

APAX-5040
24-ch digital input module

APAX-5046
24-ch digital output module

Water wall

Shade net
Insulation curtain
Winch switch

Air temperature
Relative Humidity
Sunlight
Soil Sensor
(Temperature, humidity, conductivity, pH value)

Equipment tracing back

Circulating fan
Air handling fan
Flow field fan

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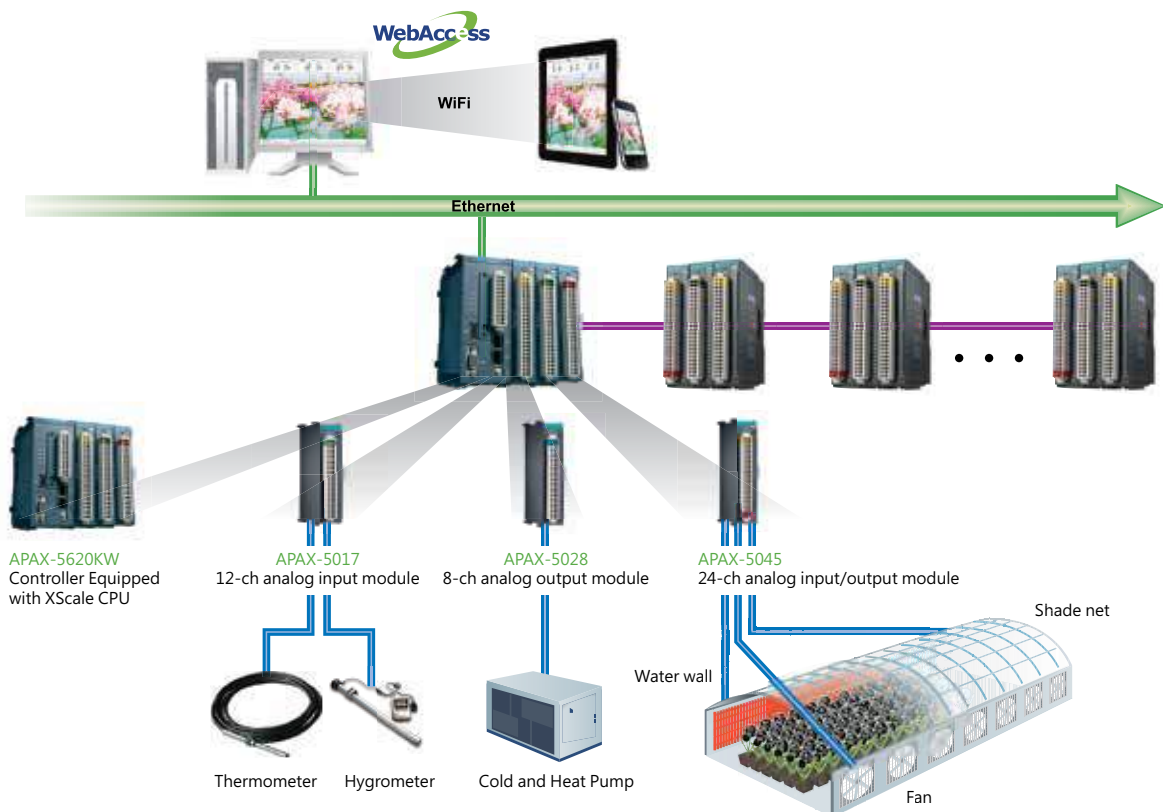# Greenhouse Environment Control Solution for Orchid Planting

Using Internet of Things (IoT) technology to build orchid greenhouse environmental control solution

Orchids are the most successful precision farming in Taiwan, and also the main kind of flowers for export. Orchids need certain temperature and humidity conditions to grow and bloom, and their flowering time may not be exactly in line with market demand, so the price collapses when there is overproduction. In the past, most environmental control systems in orchid greenhouses in Taiwan used PLCs (Programmable Logic Controller) with poor scalability and control, and could not be connected to the Internet for monitoring through the cloud. Therefore, a PAC System (Programmable Automation Controller) with both PLC programming capabilities and PC functions is a better choice. So farmers began to import automated greenhouse control systems for breeding and forcing, not only improving quality, but also controlling the production period and yield.

Advantech recommended the adoption of the APAX-5000 series of programmable automation controllers to build the control platform and to transform the greenhouse into an automatic control environment. Users are able to monitor the greenhouse environment using APAX controllers and WebAccess HMI/SCADA software, and to make adjustments when receiving alerts. With cloud monitoring, staff can monitor important data from a web browser.

System Diagram

APAX-5620KW
Controller Equipped with XScale CPU

APAX-5017
12-ch analog input module

APAX-5028
8-ch analog output module

APAX-5045
24-ch analog input/output module

Thermometer   Hygrometer   Cold and Heat Pump

Water wall

Shade net

Fan

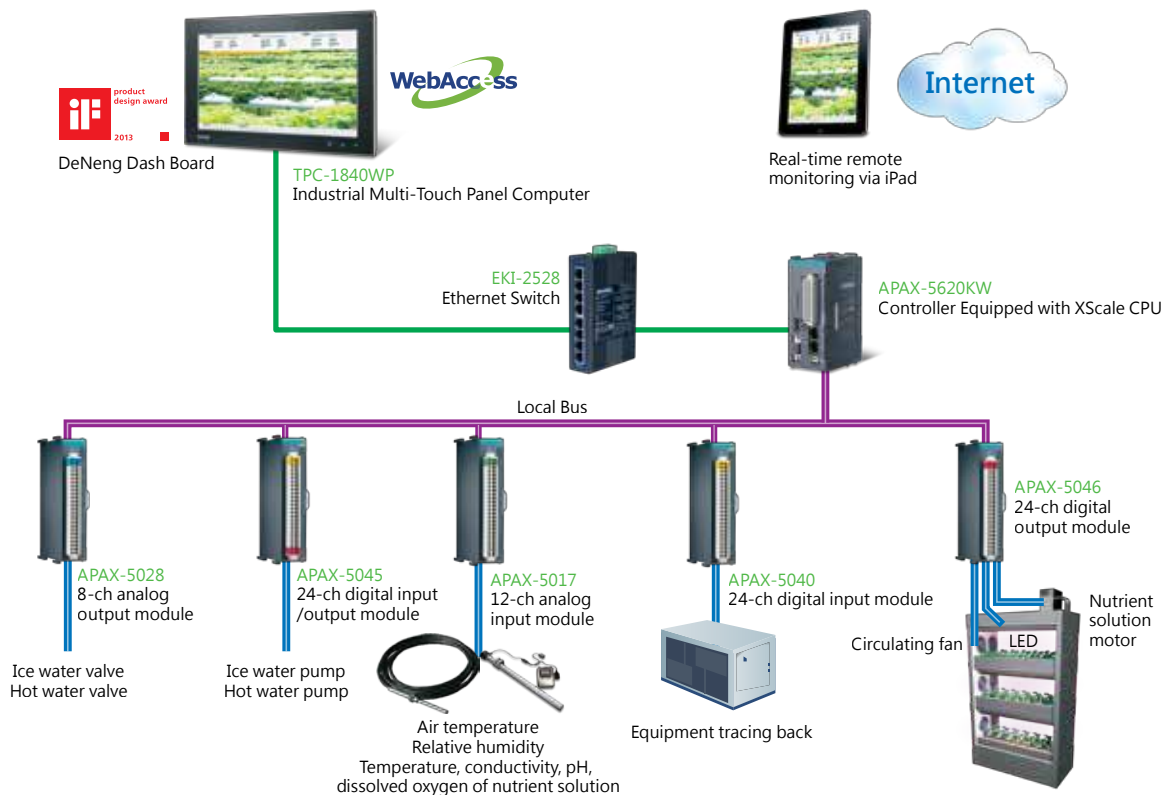# Hydroponic Vegetable Plant Monitoring System

A plant factory with a year-round harvest

IT applications have changed agricultural production. Plant factories no depend on the weather, reducing the risk by increasing control items, and producing a year-round harvest. Moreover, comprehensive hydroponic vegetable plant monitoring systems successfully cultivate crops with high economic value.

This LED lit plant factory grew a variety of crops using a three-dimensional hydroponic method of five-layer racks, and adopted the plant factory solutions. Through sensor integration, automatic control, information processing, and network communications capabilities, coupled with the cloud architecture, the system provides remote monitoring and factory automation management. Moreover, the system also provided a variety of sensors in the factory. It deployed and controlled the most important elements for healthy hydroponic vegetables: water quality and nutrient solution.

This system uses a variety of Advantech products, such as: TPC Industrial Touch PCs, APAX-5620KW Programmable Automation Controllers, and APAX I/O data acquisition modules. The APAX I/O data collection module acquires important information, such as temperature, conductivity, pH, dissolved oxygen, etc..Then, the control module regulates the cold/hot water valve and water pumps of the air conditioning system, circulation fans, LED lights, nutrient solution motors, etc. The factory saved a lot of labor for inspection and adjustment, provided the most suitable growth environment for the plant in the most energy efficient and cost-saving way.

System Diagram

DeNeng Dash Board

TPC-1840WP
Industrial Multi-Touch Panel Computer

Real-time remote monitoring via iPad

EKI-2528
Ethernet Switch

APAX-5620KW
Controller Equipped with XScale CPU

Local Bus

APAX-5028
8-ch analog output module

APAX-5045
24-ch digital input /output module

APAX-5017
12-ch analog input module

APAX-5040
24-ch digital input module

APAX-5046
24-ch digital output module

Nutrient solution motor

Circulating fan   LED

Ice water valve
Hot water valve

Ice water pump
Hot water pump

Air temperature
Relative humidity
Temperature, conductivity, pH,
dissolved oxygen of nutrient solution

Equipment tracing back

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Intelligent Agricultural Control and Monitoring System

The system uses Internet of Things (IoT) and automatic control technology to monitor greenhouse environment equipment, and to effectively control the crop cultivation conditions, such as: temperature, sunlight, humidity, air circulation, pH, CO_2, nutrient solution supply, It can be equipped with a wireless module to acquire temperature, humidity, and EC values. Wired and wireless solutions can send data via the network to the server and terminal through the gateway. Dedicated agriculture software and cloud management platform can monitor greenhouse remotely. At the same time, the professional monitoring system module can be extended to support environmental control, irrigation control of nutrient solution, emergency treatment, and alarm system.

	Monitoring Items	Control Items
Intelligent agricultural monitoring system	• Indoor temperature and humidity sensor • Soil sensors • Water quality sensor • Interior light sensor • CO_2 sensor • Outdoor thermometer • Anemometer • Wind gauge • Illuminometer	• Sunroof motor • Side window motor • Shade net motor • Outer shade net motor • Fan • Water wall pump • Irrigation water supply pump • Circulating fan

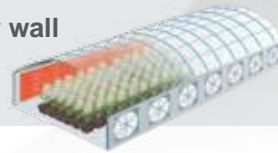|		Entry-level Edition (monitoring)	Standard Edition (monitoring + control)	Professional Edition (monitoring + control)
System	Range	$1000m^2$	$1000m^2$	$4000m^2$
	Chassis Material	Stainless Steel	Stainless Steel	Stainless Steel
	Industrial computer	PC-based controller	PC-based controller	High-end PC-based controller
	SQL Database	Included	Included	Included
	Agriculture Software	Agricultural software (Basic version) - Sensor Monitoring Software	Agricultural software (Standard Edition) - Sensor monitoring software + Control Software	Agricultural software (Professional Edition) - Sensor monitoring software + Control Software
	Industrial Ethernet Switch	4 Port 100/1000 Gigabit Ethernet Switch	8-port 100/1000 Gigabit Ethernet Switch	16-port 100/1000 Gigabit Ethernet Switch
	Serial Communication Module	1-port RS-232/422/485	2-port RS-232/422/485	8-port RS-232/422/485
	Analog Input / Output Module	12-ch analog input module 3 x APAX-5017	12-ch analog input module 3 x APAX-5017	12-ch analog input module 8 x APAX-5017
	Digital Input / Output Modules	-	24-ch digital input module 1 x APAX-5040 24-ch digital output module 1 x APAX-5046	24-ch digital input module 4 x APAX-5040 24-ch digital output module 4 x APAX-5046
	Sensors	Not Included	Not Included	Not Included
	Wireless LAN module	Not Included	Not Included	Not Included
	Wi-Fi AP	Not Included	Not Included	Not Included

Thermometer, hygrometer

Cold / Heat Pump

Nutrient solution motor LED lights

Shade net

Water wall

Fan

	Advantech WebAccess	UNO-2174G	APAX-5620KW
Functionality	**Web-based HMI / SCADA Software** • Strong networking capabilities and remote monitoring capability, along with the ability to be quickly developed into agricultural management software • Powerful remote monitoring function Users can easily see the greenhouse conditions via the Internet, and to analyze and make decisions through a remote connection	**Data Gateway** • Built-in WebAccess HMI/SCADA agriculture software, with real-time data acquisition, powerful computing capability, low power consumption, and fanless design • The most durable and reliable data acquisition platform for intelligent agriculture	**DIN-rail PC Controller** • Control host for the greenhouse environmental monitoring equipment
Specification	• Professional edition 300 tags	• Embedded operating system and data acquisition software • Supports Modbus, OPC, and other open protocols • Supports more than 200 device driver interfaces • Supports multiple database interfaces • Supports breakpoint continues transmission function	• XScale CPU • Supports Ethernet and RS-485 communication interface • Supports Modbus/TCP, Modbus/RTU protocol • Operating temperature -10 ~ 55ºC • Operating humidity 0 ~ 95%

	APAX-5017	APAX-5040	APAX-5046
Functionality	**Analog Input Module** • Sensor signal input (indoor temperature and humidity, soil, water, indoor brightness, CO_2, outdoor temperature and humidity, wind speed, wind direction, sunlight)	**Digital Input Module** • Receives signals from sunroof, side window, the shade net, outdoor shade net, fan, water wall pumps, irrigation pump, circulating fan, automatic switch, switch status, and other equipment tracing back	**Digital Output Module** • Motor control of sunroof, side windows, indoor shade net, outdoor shade net, fan, water wall pump, irrigation pumps, circulating fan, and other equipment
Specification	• 12-ch analog input • Supports input/output forms of V, mV, mA, etc. • Modbus/TCP protocol • Operating temperature -10 ~ 60ºC • Operating humidity 5 to 95% • Each input channel can be defined in different forms and ranges	• 24-ch digital input • Supports input forms of sink/source load • Modbus/TCP protocol • Operating temperature -10 ~ 60ºC • Operating humidity 5 to 95% • Each input channel can be defined in different forms and ranges	• 24-ch digital output • Supports sink output for short circuit, overheat protection • Operating temperature -10 ~ 60ºC • Operating humidity 5~95%

Choose Advantech as Your Best Partner

Founded more than thirty years ago, Advantech has become an intelligent service industry leader, and has offices around the world. Through close cooperation with a vertical field of systems integrators, Advantech provides a wider range of applications in each industry, and comprehensive smart city and Internet of Things (IoT) solutions in order to facilitate a convenient and smart life.

Advantech's mission is to continue to drive the earth to become more intelligent, to drive innovation of smart city, to build the model IoT industry, to assist industries to accelerate intelligence operations to become the most influential global businesses of smart city and Internet of Things (IoT).

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Smart city solutions

Advantech's five major smart city solutions make the system able to fully utilize Internet of Things (IoT) architecture for comprehensive sensing, reliable communications, and intelligent processing. These solutions provide a more intelligent experience to the public, business, and government, improving the overall quality and image of a city.

Digital Retail and Hospitality	Intelligent Hospital	Digital Logistics and Fleet Management

- Ustore Manager
- iCloud Solution
- In-Store Management
- Central Control and Cloud Management
- Restaurant Management

- Integrated Operating Room
- Quality Nursing Care
- Intelligent Outpatient Services

- Logistics & Warehousing Management System
- Fleet Management System

Why Advantech

Designing specific solutions according to industry characteristics

In order to offer the market new value-added services, and to meet the needs of as it moves from "product" to "services", Advantech provides innovative SRPs (Solution Ready Packages) for various professional industries. Advantech also provides application solutions for industry-specific hardware and more intelligent services to its customers, allowing customers to focus on their work, and make application integration easier.

Perfect cloud integration solutions

Advantech has been cultivating various industries for many years, understanding the purposes and needs of users, and providing appropriate hardware and software to match solutions. With particular emphasis on the product development of cloud-based architecture in recent years, WebAccess$^+$, a new industrial cloud software, provides comprehensive evolution of intelligent remote detection management service that instantly detects and accurately grasps the system state.

Model Corporate Citizen

Advantech is committed to being a model corporate citizen by helping to preserve the environment and by giving back to society. Our environmental program focuses on reducing, reusing, and recycling materials used in our manufacturing operations. Advantech's environmental compliance effort includes the following:

• ISO 9001 Certification
• ISO 14001 Certification
• ISO 13485 Certification
• OHSAS 18001 Certification
• TL9000 Quality Management System
• RoHS Directive Compliance
• WEEE Directive Compliance
• Authorized Sony Green Partner

After Service

Product Warranty
When the basic product warranty expires, users can buy warranty extensions. We provide a full-service to customers to lower maintenance costs.

Professional Installation
All new settings are tested by Advantech's professional team and we offer optional installation and integration services. After installation, we set the management and operation via the internet immediately, providing real-time information.

Complete Training
With a total training solution which including multimedia player software with user demonstrations and hands-on experience system maintenance staff can learn to operate their system in no time.

Intelligent Building and Urban Space Management

• Intelligent Space Management
• Intelligent Building Energy Management System
• Urban Space Management
• Transportation Control System

Intelligent Agricultural and Environmental Protection

• Intelligent Environmental Protection
• Intelligent Agriculture
• Intelligent Water Affairs
• Intelligent Plant Equipment Monitoring
• Oil and Gas
• Power and Energy

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ADVANTECH WebAccess/NMS
ADVANTECH WebAccess+IMM
ADVANTECH WebAccess+IVS
ADVANTECH WebAccess/SCADA

Industry-Leading Quality Assurance
Advantech is a global embedded computing researcher, developer, and manufacturer, providing various industries a variety of industrial PCs, touch screen, data acquisition modules, and other products. With stable quality assurance, Advantech products can not only be used in inside, but also outside in harsh environments. With the support of Advantech industrial computers, Advantech provides intelligent and stable project planning to industries.

Customer-oriented Support
Advantech 's complete technical and repair support provides a variety of customizable after-sales services, including extended warranty, advance replacement, upgrade, fast repair and so on. With hotline AE 24/7 technical support, we keep you investment at peak performance and within your budget.

WebAccess+ Alliance

One for All · All for One

WebAccess/SCADA
Smart HMI/SCADA Software
- 100% browser-based HMI/SCADA software
- Easy to connect and control a variety of IoT Devices
- Supports a variety of mobile devices and browsers

WebAccess+IVS
Intelligent Video Software
- Intelligent Video Platform
- Intelligent Video Analytics Modules
- Modulized SDK ready for software integration

WebAccess+IMM
Interative Multimedia Software
- Digital Signage Management Platform
- Intelligent Programming Platform
- Supports Industries and Application Scenarios

WebAccess/NMS
Network Management Software
- Network Equipment Management and Monitor
- Integration of Network Topology
- Location Identification for Wide Area Deployment

Advantech invites system integrator partners to join the WebAccess+
Alliance to jointly develop the Internet of Things (IoT) and create business opportunities

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WebAccess+ Alliance Partner

DN DeNeng Scientific Research

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Penang — 60-4-537-9188

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Moscow — 7-495-232-1692

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Cincinnati — 1-513-742-8895

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Saude-São Paulo — 55-11-5592-5355

Mexico
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Mexico City — 52-55-6275-2777

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