ICP DAS Solutions in Building Automation and Smart Homes

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In recent years, the development of a variety of networking applications has promoted much technology that, once upon a time, was only a dream. ICP DAS follows its people-oriented philosophy to create innovative smart buildings, shaping the concept and design of the smart home.

Foreword

Smart buildings provide building-wide automation solutions. Building automation systems achieve automatic mechanical and electrical control over heating, ventilation, air conditioning, drainage, power, lighting, elevators, fire protection, security, and garage management. Network all these and hook them up to a central control center for real-time monitoring and management. Automatic reactions to environmental changes are also built-in to alway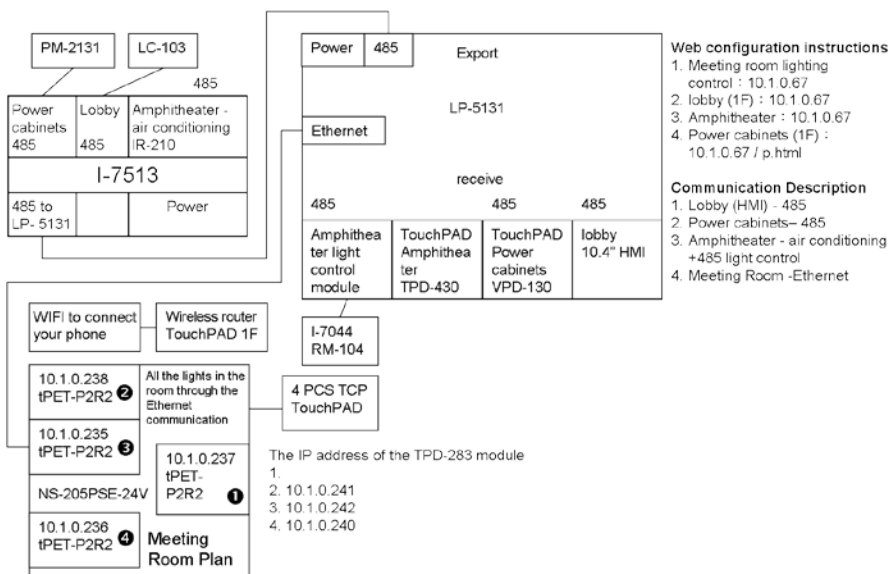s keep operation at its peak, while also keeping building occupants safe and comfortable by supplying an energy-efficient and well-crafted environment.

The Smart home and smart building are closely related. But for the residential consumer, the support is finer, more personalized, with an emphasis on home automation devices and automatic condition adjustments. All this is lashed together via a wireless terminal that constantly monitors and operates home appliances.

Introduction

As technology continues to make enormous strides forward, one must recognize the contribution that embedded applications have made to making both smart buildings and smart homes. ICP DAS does so by continuing to provide embedded applications of the highest quality to provide complete solutions for a variety of fields.

The following illustration shows a typical smart building design with ICP DAS components:

## System Description

Building Lighting

The system is controlled by the LP-5131, an embedded controller that runs a version of Linux.

It can function as a web server, provide on-site bus network control, and works with digital output module relays to control electric switches. The two controls illustrated in the network diagram are the ones that the LP-5131 controller supports: they

▲ Figure (1) : ICP DAS intelligent building solutions organization chart

use either the DCON protocol/MODBUS RTU via RS-485 serial bus or the MODBUS TCP protocol via Ethernet.

Different networks are filled with different bus modules; but ICP DAS can handle them all simply by offering a variety of on-site and distributed environment bus solutions.

See figure 2: in a distributed model of RS-485 module LC-103 and with decentralized Tiny-Ethernet modules tPET-P2R2, which directly support relay output. The room uses I-7044D and requires external RM-104 relay board outputs. For interactions between human and computer, the TPD-283 and TPD-430 are called to the bat to supplement the HMI touch screen terminal. Commands are sent to the LP-5131 controller via the network, and the corresponding modules on the network are sought out by their addresses, whereupon the control module processes I/O to operate the electric relay control switch.
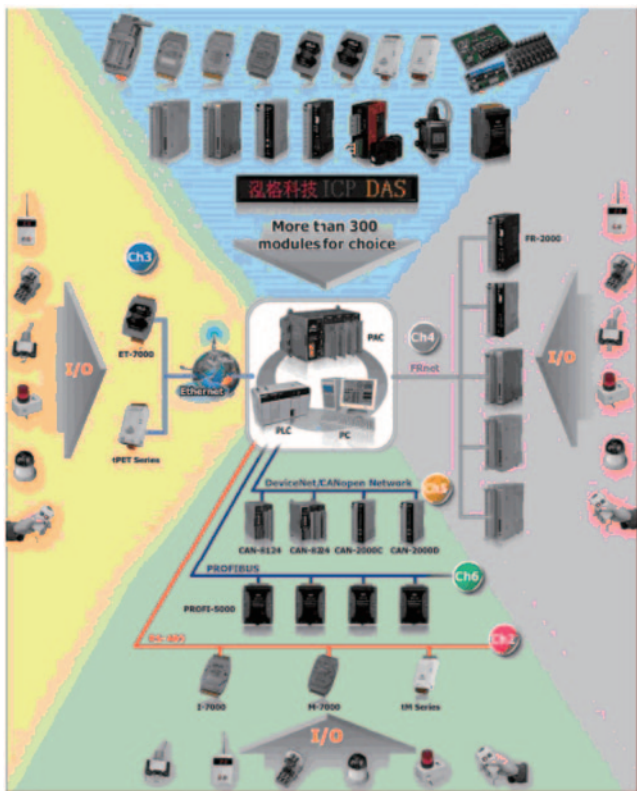
▲ Figure (2)

Building Supply and Distribution

Building supply and distribution systems have the same basic structure as lighting control. First, retrieve data of single phase voltage & current and three phase voltage & current by the Current Transformer and Potential Transformer that are connected via PM-2134, after the data is processed, display the data on the VPD-130 HMI terminal via RS-485. The system enables real-time monitoring of the power consumption and single/three phase voltage & current of the Supply and Distribution system.

Temperature and Humidity

ICP DAS' temperature and humidity module, the DL-100T485, can be interfaced directly through MODBUS RTU to get current temperature and humidity values.

Air Conditioning and Ventilation

The IR-210 from ICP DAS completes any air conditioning control system. The IR-210 is a module that can actually learn infrared commands. In addition to air conditioning, other infrared-controlled devices can be controlled with the IR-210.

Introduction to the Modules

The LP-5131 is equipped with a 520 MHz PXA270 CPU. It runs Linux (kernel 2.6.19), providing a set of rich interfaces, including VGA, USB, Ethernet, RS-232 / 485.

A wide selection of different functions are available for the I/O expansion board. The LP-5131 has an ideal control system built in that does just about everything: a high-reliability microkernel, Web, FTP, Telnet, and SSH support.

It supports LinPAC SDK, GNU C, JAVA, and GUI programming and allows connection to expansion board. It's even fitted with dual watchdog, dual

Ethernet, and dual battery backup - all in the name of redundant design. The LinPAC-5131 melds together the best features of the traditional PLC and Linux kernel to build a robust and reliable embedded control system.

LP-5131 / LP-5141 Specifications

Models	LP-5131	LP-5131-OD	LP-5141	LP-5141-OD
System Software				
OS	Linux kernel 2.6.19			
Embedded Service	Web Server, FTP Server, Telnet Server, SSH Server			
SDK Provided	Standard LinPAC SDK for Windows and Linux by GNU C language			
CPU Module				
CPU	PXA270, 520 MHz			
SDRAM	128 MB			
NVRAM	31 Byte (Battery backup, data valid up to 10 years)			
Flash	64 MB			
EEPROM	16 KB			
Expansion Flash Memory	microSD socket with one 2 GB microSD card (support up to 32 GB microSDHC card)			
RTC (Real Time Clock)	Provide second, minute, hour, date, day of week, month, year			
64-bit Hardware Serial Number	Yes, for Software Copy Protection			
Dual Watchdog Timer	Yes			
LED indicator	3 Dual-Color LEDs (PWR, RUN, L1 ~ L4; RUN, L1 ~ L4 for user programmable)			
Rotary Switch	Yes (0 ~ 9)			
VGA & Communication Ports				
VGA	Yes (640 × 480/800 × 600)			
Ethernet	RJ-45 x 1, 10/100 Base-TX (Auto-negotiating, Auto MDI/MDI-X, LED indicators)		RJ-45 x 2, 10/100 Base-TX (Auto-negotiating, Auto MDI/MDI-X, LED indicators)	
USB 1.1 (host)	2		1	
Audio Port (Microphone-In and Earphone-Out)	-	Yes	-	Yes
COM 1	RS-232 (RxD, TxD and GND); Non-isolated			
COM 2	RS-485 (Data+, Data-); 2500 VDC isolated			
COM 3	RS-232 (RxD, TxD and GND); Non-isolated			
I/O Expansion				
I/O expansion bus	I/O expansion board optional			
Mechanical				
Dimensions (W x L x H)	91 mm x 132 mm x 52 mm			
Installation	DIN-Rail			
Environmental				
Operating Temperature	-25 °C ~ +75 °C			
Storage Temperature	-30 °C ~ +80 °C			
Ambient Relative Humidity	10 ~ 90% RH (non-condensing)			
Power				
Input Range	+10 VDC ~ +30 VDC			
Isolation	1 kV			
Consumption	4.8 W	6 W	4.8 W	6 W

Applications

The LP-5131 / 5141 is easily used in factory settings, general purpose buildings, communities, and private property. Its uses are more expansive than that, as our creative customers continue to demonstrate.

Conclusion

The smart home has changed the traditional system of home control, so that the whole family can be safer, wiser, and perhaps friendlier to the environment. ICP DAS leads on the charge for the future development of the hearth and home.