Airborne™ 802.11b Wireless LAN Node Module

Embedded Wireless Networking for Industrial Control

Introduction

Central and remote management is common in the IT world, but rarely used for operating industrial equipment. A major deterrent is the difficulty and cost of running cables and wires in an industrial setting. In addition, the expense of maintaining wired infrastructure could generate considerable red ink, reducing an asset into a liability.

Monitor and Control Without Wires

Industrial equipment with integrated 802.11b (Wi-Fi) standard wireless capability frees companies from deploying a wired infrastructure. It also simplifies the task of data input and retrieval, and allows manufacturing personnel to operate, maintain and troubleshoot many machines from one central or remote workstation. It also enables remote access and control via the Internet with pervasive devices such as web-enabled PDAs and laptops.

Engineers who bare the challenge of adding wireless capability into their OEM products must combine the right hardware and software elements. Not all wireless solutions are created equal. Off-the-shelf solutions, for example, do not provide all of the components necessary for wireless deployment in an industrial setting.

Embedded Wireless Requirements

A more practical solution involves the use of embedded wireless systems integrated into each piece of industrial equipment. Although this solution leverages relatively new technology, the approach has been tried, tested, and deployed successfully in a variety of industrial settings. Embedded wireless capability requires an application processor, radio, base-band controller, antenna, Media Access Control (MAC) driver, protocol stack, application software, and management interfaces. Additional requirements include support for common industrial equipment data interfaces, including RS-232, RS-422, and RS485, as well as General Purpose (digital) IO (GPIO) and analog inputs. This approach facilitates communications with a wide variety of industrial equipment.

Sourcing a hardware chip-set that includes radio, base-band, and RF capability can be challenging because chip-set manufacturers are often reluctant to sell and support their products to companies that lack sufficient wireless expertise.

Selecting a suitable embedded operating system that supports both a TCP/IP stack and the radio MAC driver is important. Choosing an integrated module with both elements provides a simple logical interface for developers allowing them to add wireless capability without expertise in networking protocols, software stacks, RF circuit design, or wireless network configuration.

Embed Quatech's Airborne™ 802.11b Wireless LAN Node Module into OEM applications in as little as 6 weeks.

- Highly integrated 802.11b wireless module with radio, base-band & application processor
- Built-in web server enables drop-in LAN and Internet connectivity
- Quick time-to-market & reduced development costs
- Reduces need for RF and communications expertise
- Integrated RTOS and TCP/IP Stack
- Configurable serial, digital & analog I/O ports

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Proprietary vs. Standards-Based Solutions

Developers must also carefully consider whether to leverage standard or proprietary wireless local area network (WLAN) technology. Proprietary wireless solutions provide point-to-point connectivity and advantages in situations where latency or overall throughput goals are not satisfied by standards-based products. However, proprietary solutions typically interoperate with a limited number of third-party wireless solutions. This adds significant cost and complexity to the design and limits the size of the potential market.

On the other hand, a standards-based approach provides considerable advantages. The 802.11 standards have been designed specifically to handle performance and security concerns. This allows products based on their technology them to work with a wide variety of equipment from a range of different vendors. A standards-based approach assures that the product will work with a broad base of “best in class”, proven products that are competitively priced.

Tradeoffs of Competing Wireless Standards

Developers must also weigh the three competing 802.11 standards: 802.11a, b, and g. Each has its strengths and limitations. For example, 802.11 a or g technologies could be used for equipment housed in a relatively small warehouse. These wireless standards provide faster throughput (typically 54 Mbps for 802.11a and 802.11g) and operate in frequency spectrums that are relatively interference free. However, 802.11a and g technologies can only send data up to 70 or up to 100 feet respectively.

Thus these technologies are suitable for applications that require high throughput and low interference, but may not be the best solution when wide coverage is required. Since “a” and “g” signals travel shorter distances, companies that use either technologies require a larger number of wireless access points, increasing cabling and wiring and therefore costs.

By contrast, 802.11b, the de facto wireless standard is a mature, stable standard that carries data for much greater distances (up to 300 feet at 1 Mbps indoors and up to 1,500 feet at the same speed outdoors). It is ideal for use in manufacturing and industrial environments that are spread over a large area. Though throughput via 802.11b technology is lower (11 Mbps maximum) than that provided by “a” and “g,” it offers more than enough for most low-data industrial applications. In addition, both “a” and “g” technologies consume considerably more power than 802.11b, thus increasing operating expenses.

Industry-Specific or Web-based Interfaces

No embedded wireless solution would be complete without an integrated solution that transmits data from equipment or sensors to the person who ultimately controls them. This can be accomplished using either web-based or industrial control specific standards-based interfaces. Each method has distinct advantages, depending on the application.

OLE for Process Control (OPC) servers and Supervisory Control and Data Acquisition (SCADA) clients are common standards. These can be used to either “pull” information or “push” data. “Pull” architecture is best suited when periodic data or control access is needed. “Push” architecture is commonly used to transmit alerts and alarms, or for recording status changes. OPC and SCADA-based interfaces provide a stable, tested alternative in industrial environments that utilize dedicated machinery that don’t need to interoperate with diverse types of equipment.

However, web interfaces provide more flexibility. Not only can they be used for “push and “pull” applications, they are highly portable for easy integration. In addition, they can be used with a wide variety of computers and operating systems (including Windows, Macintosh, Unix, or Linux) that utilize standard web browsers, unlike OPC and SCADA-based solutions.

Web interfaces are typically user friendly, with intuitive tools for easy operation. They can be designed with basic text and graphics or with complex data-driven pages, graphs, settings, and measurement displays. Proprietary interfaces usually are not easily customized. By using a standard web interface, operators can access industrial machines from any location via the Internet. Plus, web-based interfaces can be used with a wider variety of industrial equipment, providing interoperability with a diverse array of machines and operating systems.

The Solution: A Drop-In Wireless Module

Developers attempting to integrate embedded wireless capability in industrial equipment can either develop their own solution or leverage “drop-in” modules. The solution developed by Quatech. integrates all wireless functions – the application processor, radio, base-band controller, antenna, MAC driver, protocol stack, application software, and web server – into a single unit, freeing developers the time, trouble, and expense of producing their own device. With the Quatech Airborne™ Wireless LAN can equip products with wireless capability in a few weeks, greatly reducing their time to market.Node Module, developers can equip products with wireless capability in a few weeks, greatly reducing their time to market.

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