Introduction of Field Server

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Field Server

Field Server is one of the Web-based field monitoring units equipped with a wireless LAN, an Internet camera, and a sensing processor with a Web Server (Fig. 1). Field Server has some sensors such as air temperature, relative humidity, solar radiation, and CO2 concentration, and these data are displayed on a Web page which can be accessed using a Web browser such as Internet Explorer. In the Field Server, every module is connected to each other with Ethernet and it is easy to exchange or add modules such as high performance camera. Sensor data and image data are sent by wireless LAN which provides high-speed transmission and long-distance communication. Field Server works by a commercial power supply, external solar battery, or embedded small solar cell (driving in energy-saving mode).

Network Architecture

Each Field Server communicates with wireless LAN and constructs mesh network in the monitoring field (Fig. 2). Moreover, Field Server provides Wi-Fi hotspot in which everyone can use the Internet when this network is connected to global line such as FTTH, ADSL, and VSAT. We can manage Field Servers from anywhere at any time via the Internet, and it enables this system to built a distributed architecture by remote control system. Only by deploying Field Servers and connecting them to the Internet, non-expert users in a farm field can easily get the monitoring data on the Web which is created by the remote control system.

Agent Control System

Field Servers are controlled by an agent system, which accesses all types of Web-based modules seamlessly on the Internet (Fig. 3). The agent system autonomously operates based on parameter files (Profiles) and performs complicated actions to the Field Servers with production rules. In this system, we can not only monitor Field Servers but also operate attachment devices of them such as pesticide
sprayer, irrigation machinery, and heating system according to their situation. Monitoring data collected by the agent system is stored as a Web-based database opened to the public. The agent system can also analyze the monitoring data by using Web applications such as image processing and signal processing, so it provides versatile and easily expandible function without changing the system architecture.

**Data Viewer and Image Viewer**

We can access sensor data and image data on some Web pages which are described with JavaScript, Java Applet, or Java Servlet. The sensor data stored in a XML format is shown as time series lists or itemized graphs. The image data is shown as a functionable time-lapse motion picture which can choose some images on specific times and change display speed, range, and period selected by GUI tool bars. These data can also be linked with associated applications such as unusual image detection for surveillance and MetBroker which is a middleware for weather data that provides various agricultural models.

**Field Server World**

Approximately 100 Field Servers are deployed in various parts of Japan, the United States, Thailand, China, Korea, Taiwan, Indonesia, Philippines, Fiji, Syria and Nepal since February, 2002 (Fig. 5). Some Field Servers connected to the Internet are managed by the agent system and the total collected data in this system surpasses about 1 terabyte in a year. This system uses not only for the purposes of monitoring agricultural field but also for managing greenhouses, keeping products under surveillance, and exposing as publicity. In these days, it has been developed to the situation for urban area, for the production process disclosure and traceability, for the observation of global warming, and so on. Our proposed system has the availability and expandibility for various applications.


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