

SYSTEMS AND METHODS FOR MONITORING AND CONTROLLING REMOTE DEVICES

CROSS REFERENCE TO RELATED APPLICATIONS & PRIORITY CLAIMS

5 This application is a continuation of copending U.S. patent application Ser. No. 12/337,739, entitled System and Method for Monitoring and Controlling Remote Devices and filed on 18 December 2008; which is a continuation of U.S. Patent Application Number 11/395,685, entitled, "System and Method for Monitoring and Controlling Remote Devices," filed on Mar. 31, 2006, issued as U.S. Pat. No. 7,468,661; which is a continuation of U.S. patent application Ser. No. 10/139,492, entitled, "System and Method for Monitoring and Controlling Remote Devices," filed on May 6, 2002 and now U.S. Pat. No. 7,053,767; which is a continuation of U.S. patent application Ser. No. 09/439,059, filed on Nov. 11, 1999 and entitled "System and Method for Monitoring and Controlling Remote Devices," now U.S. Pat. No. 6,437,692. U.S. Pat. No. 6,437,692 is a continuation-in-part of U.S. patent application Ser. No. 15 09/271,517, filed Mar. 18, 1999 and entitled, "System for Monitoring Conditions in a Residential Living Community", which is a continuation-in-part of U.S. patent application Ser. No. 09/102,178 filed Jun. 22, 1998 and entitled, "Multi-Function General Purpose Transceiver," now U.S. Pat. No. 6,430,268, which is a continuation-in-part of U.S. patent application Ser. No. 09/412,895, filed Oct. 5, 1999 and entitled, "System and Method for Monitoring the Light Level 20 Around an ATM," now U.S. Pat. No. 6,218,953; which is a continuation-in-part of U.S. patent application Ser. No. 09/172,554, filed Oct. 14, 1998 and entitled, "System for Monitoring the Light Level Around an ATM," now U.S. Pat. No. 6,028,522; and further claims the benefit of U.S. Provisional Application Ser. No. 60/146,817, filed Aug. 2, 1999 and entitled, "System and Method for Monitoring and Controlling Residential Devices." Each of the above identified 25 applications and patents are incorporated herein by reference in their entireties.

TECHNICAL FIELD

Embodiments of the present invention generally relate to remotely operated systems, and more particularly to a computerized system for monitoring, reporting on, and controlling remote 30 systems by transferring information signals through a wide area network (WAN) and using software applications hosted on a connected server to appropriately process the information.

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BACKGROUND

As is known, there are a variety of systems for monitoring and controlling manufacturing processes, inventory systems, emergency control systems, and the like. Most automatic systems use remote sensors and controllers to monitor and automatically respond to system parameters to reach desired results. A number of control systems utilize computers to process system inputs, model system responses, and control actuators to implement process corrections within the system. Both the electric power generation and metallurgical processing industries have had success controlling production processes by implementing computer controlled control systems in individual plants.

One way to classify control systems is by the timing involved between subsequent monitoring occurrences. Monitoring processes can be classified as aperiodic or random, periodic, and real-time. A number of remotely distributed service industries implement the monitoring and controlling process steps through manual inspection and intervention.

A periodic monitoring systems (those that do not operate on a predetermined cycle) are inherently inefficient as they require a service technician to physically traverse an area to record data, repair out of order equipment, add inventory to a vending machine, and the like. Such service trips are carried out in a number of industries with the associated costs being transferred to the consumers of the service.

Conversely, utility meter monitoring, recording, and client billing are representative of a periodic monitoring system. In the past, utility providers sent a technician from meter to meter on a periodic basis to verify meter operation and to record utility use. One method of cutting operating expenses in the utility industry involved increasing the period at which manual monitoring and meter data recording was performed. While this method decreased the monitoring and recording expense associated with more frequent meter observation and was convenient for consumers who favor the consistent billed amounts associated with "budget billing," the utility provider retained the costs associated with less frequent meter readings and the processing costs associated with reconciling consumer accounts.

Lastly, a number of environmental and safety systems require constant or real-time monitoring. Heating, ventilation, and air-conditioning systems, fire reporting and damage control systems, alarm systems, and access control systems are representative systems that utilize real-

time monitoring and often require immediate feedback and control. These real-time systems have been the target of control systems theory and application thereof for some time.

A problem with expanding the use of control systems technology to distributed systems are the costs associated with the sensor-actuator infrastructure required to monitor and control functions within such systems. The typical approach to implementing control system technology is to install a local network of hard-wired sensors and actuators along with a local controller. Not only is there expense associated with developing and installing appropriate sensors and actuators but the added expense of connecting functional sensors and controllers with the local controller. Another prohibitive cost associated with applying control systems technology to distributed systems is the installation and operational expense associated with the local controller.

Accordingly, an alternative solution to applying monitoring and control system solutions to distributed systems that overcomes the shortcomings of the prior art is desired.

SUMMARY OF EXEMPLARY EMBODIMENTS

Certain objects, advantages and novel features of the invention will be set forth in part in the description that follows and in part will become apparent to those skilled in the art upon examination of the following or may be learned with the practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve the advantages and novel features, the present invention is generally directed to a cost effective method of monitoring and controlling remote devices. More specifically, the present invention is directed to a computerized system for monitoring, reporting, and controlling remote systems and system information transfer by transmitting information signals to a WAN gateway interface and using applications on a connected server to process the information.

Because the applications server is integrated on a WAN, Web browsers can be used by anyone with Internet access (and the appropriate access permissions) to view and download the recorded data.

In accordance with a broad aspect of the invention, a system is provided having one or more sensors to be read and/or actuators to be controlled remotely, ultimately through a computer on the Internet. The sensors and/or actuators are interfaced with wireless transceivers that transmit and/or receive data to and from the Internet. In this regard, additional wireless

transceivers may relay information between the transceivers disposed in connection with the sensors and actuators and a gateway to the Internet. It should be appreciated that, a portion of the information communicated includes data that uniquely identifies the sensors and/or actuators.

5 In accordance with one aspect of the invention, a system is configured to monitor and report system parameters. The system is implemented by using a plurality of wireless transceivers. At least one wireless transceiver is interfaced with a sensor, transducer, actuator or some other device associated with the application parameter of interest. In this regard, the term "parameter" is broadly construed and may include, but is not limited to, a system alarm condition, a system process variable, an operational condition, etc. The system also includes a
10 plurality of transceivers that act as signal repeaters that are dispersed throughout the nearby geographic region at defined locations. By defined locations, it is meant only that the location of each transceiver is known to a central computer. The central computer may be informed of transceiver physical locations after permanent installation, as the installation location of the transceivers is not limited. Each transceiver that serves to repeat a previously generated data
15 signal may be further integrated with its own unique sensor or a sensor actuator combination as required. Additional transceivers may be configured as stand-alone devices that serve to simply receive, format, and further transmit system data signals. Further, the system includes a local data formatter that is configured to receive information communicated from the transceivers, format the data, and forward the data via the gateway to one or more servers interconnected with
20 the WAN. The server further includes means for evaluating the received information and identifying the system parameter and the originating location of the parameter. The server also includes means for updating a database or further processing the reported parameters.

Consistent with the broader concepts of the invention, the "means" for evaluating the received information and the "means" for reporting system parameters are not limited to a
25 particular embodiment or configuration. Preferably, these "means" will be implemented in software that is executed by a processor within a server integrated with the Internet. However, dedicated WANs or Intranets are suitable backbones for implementing defined system data transfer functions consistent with the invention.

In one embodiment, a client retrieves configured system data by accessing an Internet
30 Web site. In such an embodiment, a system consistent with the present invention acts as a data

collector and formatter with data being delivered upon client request, with availability twenty-four hours a day, seven days a week.

In more robust embodiments, a system can be configured to collect, format, and deliver client application specific information on a periodic basis to predetermined client nodes on the WAN. In these embodiments, client intervention would serve to close the feedback loop in the control system.

In yet another embodiment, a system can be configured to collect, format, and control client application specific processes by replacing a local control computer with a WAN interfaced server and integrating system specific actuators with the aforementioned system transceivers.

It should be further appreciated that the information transmitted and received by the wireless transceivers may be further integrated with other data transmission protocols for transmission across telecommunications and computer networks other than the Internet. In addition, it should be further appreciated that telecommunications and computer networks other than the Internet can function as a transmission path between the networked wireless transceivers, the local gateways, and the central server.

In yet a further embodiment, a system can be configured using the present invention to translate and transmit control signals from an existing local controller via the networked wireless transceivers. In this regard, the system of the present invention would require a data translator to tap into the data stream of an existing control system. Distinct control system signals may be mapped to function codes used by the present invention in order to provide customer access to control system data. In this way, the system of the present invention can be integrated with present data collection and system controllers inexpensively, as customers will only have to add a data translator and a wireless transmitter or transceiver as the application demands. By integrating the present invention with the data stream generated by present monitoring and control systems, potential customers enjoy the benefits of the present invention without the difficulties associated with integrating sensors and actuators to monitor individual system parameters.

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