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Development of a system that uses mobile agents and sensor networks to track the status of equipment rooms

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Abstract

Traditional environmental monitoring systems have relied on cable transmission, which is notoriously expensive, inaccurate, and difficult to set up. Some technological solutions, such as those using mobile agents and WSNs, may be able to fix the issues. In this paper, we propose a new approach to environmental monitoring. After keeping an eye on the inside settings, our system may instantly sound alarms if something out of the norm happens. After implementing the proposed method, a company's management became much more effective. Elsevier Ltd. is the publisher.

Keywords: *Agent on the go; network of wireless sensors; tracking of the natural world*

Introduction

As our society becomes increasingly reliant on digital infrastructure, computer networks are taking on more significance. All of the hardware in an equipment room, including computers, servers, UPS, and air conditioners, has to be kept at the ideal temperature, humidity, and electrical current levels. Due to management teams' inability to promptly identify equipment problems, network disruptions are common in equipment rooms that depend on outdated maintenance techniques. This highlights the need of building a state-of-the-art equipment room system capable of meeting general and specialized requirements. Equipment protection, alerts, and problem detection all depend on an environmental monitoring system. In order to maintain efficient environmental management in the equipment room, it is imperative that any issues be addressed promptly. The efficiency of the network has a direct correlation to the dependability of the systems in the equipment room. Most current environmental monitoring systems rely on cable transmission, which has a number of drawbacks including high cost, unstable operation, disposal hassles, and difficulty in identifying faults. When the topic of wireless communication comes up, these days it seems like everyone is referring about Wireless Sensor Networks (WSNs). Embedded computers, sensor technology, modern networking, and wireless communications are all a component of it. Microsensor nodes with wireless transition and compute capabilities, when deployed in large numbers, comprise a WSN. Its network topologies often exhibit self-organizational traits. Software that can walk about on its own and obey orders is called a Mobile Agent (MA). In order to interact with an object, MA may go to its storage system and use the shared network or hosting that the item offers. This study set out to combine WSN and MA technologies in order to provide a solid

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groundwork for an IEMS in a data center's mechanical room. Through wireless networks, the sensor nodes of the framework gather information about the environment around the equipment. The data streaming in from the sensor nodes is managed by the mobile agent technology. Management can work more efficiently, less manual tasks are needed, and problems may be found faster when equipment rooms can be watched remotely.

Works Cited

The Application of WSN Technology Allows for Distributed networks of inexpensive sensor nodes are used to gather data in a WSN. Equipped with processing and communication capabilities, sensor nodes may examine, collect, analyze, and communicate data on objects in the monitored area that are visible to the naked eye. Among the many environmental factors that these nodes may track are temperature, humidity, electrical current, pressure, and many more. The sensor nodes can autonomously arrange themselves and distribute randomly over the workspace; they can analyze data acquired from the real world at the local level; and they can interact adaptively with other nodes to communicate and route this data. Thanks to these benefits, wireless sensor networks are seeing increased use in civilian applications [2-4] and surveillance [1], encompassing areas such as healthcare, environmental protection, the armed forces, and even the average household. As described in References [5, 6], the data is collected by the dispersed sensor nodes without the need for a multi-hop architecture and then relayed to the end users via the sink node. With the help of the nodes' protocol stack, sensor nodes are encouraged to work together, data is integrated with networking protocols, power is effectively delivered via wireless media, and routing awareness is combined with power. Application, transportation, network, data connection, physical, power management, mobility, and task management are the layers that make up the stack of protocols. Some studies focusing on various stages of technological development are also included in reference [6].

Technology for mobile agents

After combining AI with object-oriented distributed computing, a new software method dubbed agent-based systems [7] was born. In [8], Franklin and Graesser formally describe agents and how they differ from regular computer programs. Reducing network traffic, minimizing network delays, and giving fault-tolerant service with dependability were among the seven benefits of mobile agents cited by Lange in Ref [9]. The uses and advantages of mobile agents are discussed in many places [10–16]. Lastly, the organization of the business Here are the procedures to follow in order to build a system that can monitor the atmosphere of the equipment room. Figure 1 shows the system architecture, which consists of the wireless sensor network, control, and application layers. Perhaps the most optimal layer to get data from wireless sensor networks is the one that deals with temperature, water leakage, and power consumption. Transmission of collected data to the command layer is carried out by the sink node. The servers that handle applications and data are located at the control layer. The control program is operated by the application server, which may receive data from the sink node. The application saves the data to the database server after processing and review. Transmitting historical data to management across a wired local area network and seeing data

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in real-time are two of the numerous functions given by the system. If there's an issue, like the temperature going up too high, the control software will immediately call the management team to let them know. The application layer is responsible for providing the user interface. Environmental monitoring in real-time and service requests are examples of activities that may occur at the administrative layer. Urgent notification will be sent to the administrative team in the event that an alert is detected by the control software. At this stage, users may inquire about the temperature of a certain cabinet, for example, by sending a message to the wireless sensor network.

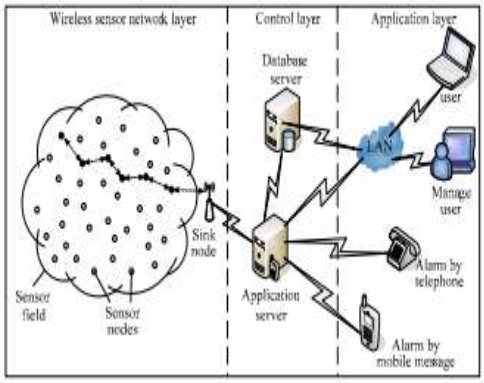

Fig.1. The scheme of environment monitoring system for equipment room;

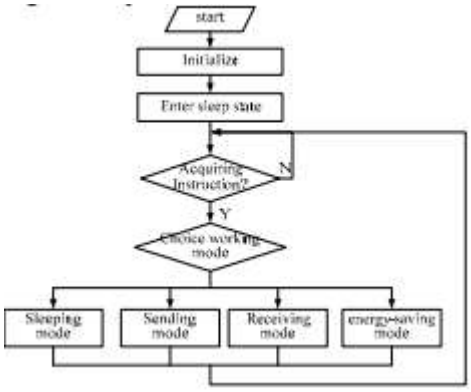

Fig.2 The operation process on Unicells

Design and Implementation

The design and implementation of wireless sensor node

The wireless sensor network layer serves as the architecture's basis, as seen in Figure 1. Rooms are equipped with sensor nodes in their corners. Every node in the network gathers data about its surroundings using radio signals sent by its in-built sensors. The UbiCell node, created by academics at Nanjing University of Posts and Telecommunications, is used in this deployment. Among the several CPUs used by the UbiCell platform is the dependable and sturdy Atmega128L. At a clock rate of 7.3728MHz, the longest period that may pass between instructions is 135.6ns. The chip's CC1000 transceiver allows for a reliable data rate of 76.8KBaud/s. Figure 2 shows the operating mechanism of the UbiCell node.Designing and executing protocols (4.2) Every sensor node has the potential to

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gather data and send it to the central hub. In this way, the protocols control the communication and synchronization processes. According to the results presented in Section 2, only a handful of algorithms are really important for the protocol stack. The UbiCell nodes' communication protocol, ZigBee, is based on the IEEE 802.15.4 standard, which is well-suited to the surroundings. Next, we settle on a data-driven routing strategy. "Directed diffusion" [17] is a proposed technique for gathering data. The goal is to monitor events that a local area network (LAN) of nodes would typically pick up on. A sensing task is broadcast as an object of interest in a sensor network. We create informational nodes that can answer our questions with relevant facts.

The development and deployment of a mobile agent design

Using the protocol and algorithm presented in subsection 4.2, the sensor nodes in this system may send their data to the network administration team. Sensor nodes keep a constant eye on the surroundings and relay the data back instantly to ensure a seamless flow of information. But as the number of sensor nodes expands, so does the volume of data flowing across the network. The end consequence is a substantially quicker death for a single node. The overall impact on the wireless sensor network is increased data transfer rates. However, the issue could not be fixed by decreasing the rate at which data was sent; otherwise, the network manager would not be alerted to environmental issues in a timely fashion. Mobile agent technology is used here to help with dispute resolution. In the context of WSN, as stated in the introductory section, mobile agents may be given permission to access not only their own data, but also the data stored in the sensor nodes. They can read sensor information, communicate amongst nodes, and move around on their own. The mobile agents will be sent from the sink node to the sensors. And the dispatch routing protocol is the directed diffusion routing protocol described in subsection 4.2. The steps taken by the mobile agent and its connection to the dispatcher are shown in Fig. 3.

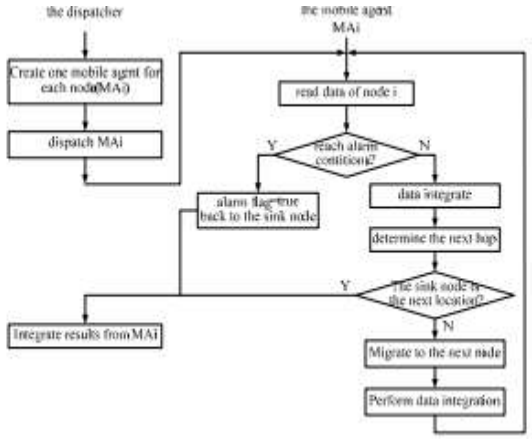

Fig.3 the process of the mobile agent and its relationship with its dispatcher

Consider the sink node to be a stand-in for the processing unit in charge of the monitoring service. Let's call the n mobile agents sent out by the sink node "MA1,...,MAi,...,MAn." Once MAi receives a job assignment, it immediately begins gathering information from sensor node i. MAi instantly route this alert if the monitoring data reaches the alarm criteria and send it back to the sink node. If not, MAi will carry the integrated data and information with it as it moves on to the next step. The MAi itinerary has been completed successfully if the next hop is the sink node. After then, sensor node data is incorporated on purpose in accordance with the MAi. Agilla, which offered a mobile-agent-based programming paradigm for use in wireless sensor networks, serves as the platform upon which we deploy our method.

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Developing an App for Service and Putting It to Use

After the wireless sensor network layer has been deployed, the sink node collects the monitoring data and sends it to the end user over the intranet. After that, the records are saved to the database server by the service application program. Historical, snapshot, and long-running queries are the three main types of user questions. Among the features that the program should have are the following: the ability to examine important or abnormal measure acquisition; the ability to review real-time environmental information of the room; the ability to set alert thresholds; the ability to query and analyze historical data and visualize it in a chart. The system notifies the management team of any unusual conditions—in this example, an unusual temperature—and requests that they address the issue. An object-oriented methodology was used in the development of the program. The packing scheme is seen in Figure 4. The arrangement of the sequence diagram is shown in Figure 5. User interface component that is dedicated to the subsystem that collects data for the monitoring system Wireless sensor network (WSN) data tracking and administration solution for wirelessly connecting to the outside world Sensor network

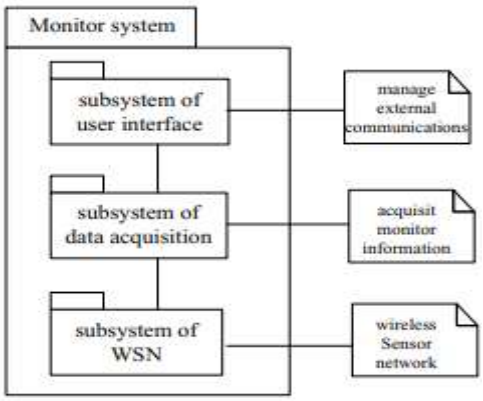

Fig.4 the design of package diagram;

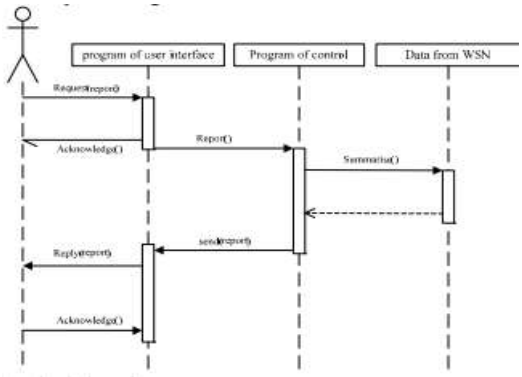

Fig.5 the design of sequence structure

Conclusion

A system for environmental monitoring based on WSNs and MAs is developed and implemented in this research. A company has been experimenting with the method for a while now. The efficacy of management has increased noticeably. The proposed system design has many distinct benefits, including the following: To begin, by using WSN technology for environmental monitoring, the

difficulties of expensive and time-consuming deployment may be circumvented, allowing for the achievement of unmanned monitoring. (2) By reducing data flow and latency, networks with mobile agents enhance dependability and fault tolerance. Thirdly, mobile agents in WSN aid with load balancing and node lifetime without adding delay to the network. Improvements in the future will concentrate on fixing the system's security holes.

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